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# THE RADICAL ENLARGEMENT OF THE ARTIFICIAL WATER-WAY BETWEEN THE LAKES AND THE HUDSON RIVER.

By E. SWEET, M. Am. Soc. C. E.

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## WITH DISCUSSION.

The Erie Canal, conceived by the genius and achieved by the energy of DeWitt Clinton was, during the second quarter of this century, the most potent influence of American progress and civilization. It developed the Northwest by giving an outlet to the commerce of the Great Lakes, and it made New York the Empire State, and New York City the imperial mart of the New World.

For twenty years after its size was increased to its present capacity, it also continued to play a prominent part in our internal commerce. Contemporaneous, however, with its enlargement began that wonderful development of the Railway System of transportation which has since absorbed the skill and resources of our profession, the best executive and administrative talent, and much of the available capital of our country, to the exclusion of water routes, so that our neglected canal, unchanged for 30 years except as to the gradual deteriora-

tion of its structure, with unimproved equipment and modes of operation, despite the liberal policy of the State, is gradually losing its capacity for usefulness and its influence on the problem of transportation. Thirty years ago the Erie Canal carried nine-tenths of the freight traffic between Buffalo and New York, while now it carries less than one-fifth of it. In view of these facts thoughtful men begin to ask themselves the question what must its future be.

For some years friends of this canal have urged minor improvements which, if promptly adopted, would have measuredly increased its capacity and economy and prolonged its ascendency, but its inadequacy to meet the present and prospective wants of the Northwestern commerce seeking the East and the sea have now become so manifest and so great as to demand a far more radical and extensive improvement.

It is clear to me that the canal, to become the permanent highway of this commerce, must have sufficient capacity to float the largest vessels navigating the great lakes from Lake Erie to the deep waters of the Hudson, and in view of the fact that the draught of the lake vessels is now limited by the dimensions of St. Mary's and St. Clair Canals, which may hereafter be enlarged, the locks of our canal should be large enough to provide for the probable increase in the size of lake vessels.

The canal should be at least 18 feet deep, and 100 feet wide at bottom, and its locks should be 450 feet long and 60 feet wide. The successful operation of the canal thus enlarged requires that it should receive its water from the lake and discharge it into the Hudson, on account of the insufficiency of water tributary to its route to supply it.

This and various topographical and economic considerations render a radical change in parts of the route and profile of the old canal essential.

These changes are entirely practicable and involve no very serious difficulties.

The essential change in profile consists in extending the Rome level westward to Lock 57, between Newark and Lyons, in Wayne County, throwing out the locks 47 to 56, inclusive. This change in profile can be effected by swinging the route to the southward, near Newark, crossing the Canandaigua outlet and occupying ground of the proper elevation along the south side of Clyde River, and crossing the Seneca River at the narrowest part of its valley, which is near its junction with the outlet of Cayuga Lake, from whence it should gradually approach

the present route of the canal, and connect with or cross it just east of the City of Syracuse.

The only serious difficulty encountered on this route is the crossing of the Seneca River, where the water surface of the canal must be nearly 50 feet above that of the river, and for nearly two miles over 40 feet above the surface upon which its embankment must be built.

This change of route, to secure a continuously descending profile from the lake to the Hudson River, is the only deviation from the route of the old canal that is absolutely necessary, but I think the construction would be simplified and cheapened, and the best possible waterway secured, by the adoption of an entirely new route from Syracuse eastward.

Lower ground can be obtained for the Rome level, except at the summit itself, by moving the line northward, thus, by lowering the elevation of this level throughout, lessening the difficulties of the Seneca River crossing, and from a point a little west of Utica eastward to the Hudson, the Mohawk River should be canalized by the erection of locks and movable dams at suitable points in its course, and the deepening and rectification of its channel.

From the mouth of the Mohawk, at Troy, to the deep water of the Hudson River, below Coxsackie, that river must be improved by narrowing and deepening its channel, or a canal must be constructed along its shore. The former method of construction affords, in my judgment, the simplest and most useful means of securing the desired result.

The plan may, therefore, be summarized as the widening, deepening and necessary rectification of the worst curvatures of the present canal, from Buffalo to Newark, about 130 miles, the construction of a new canal from Newark to Utica, about 115 miles, the canalization of the Mohawk River from Utica to Troy, about 100 miles, and the improvement of the Hudson River from Troy to Four Mile Point, in Coxsackie, a distance of about 30 miles.

The elevation of the western level of the canal being governed by the surface of Lake Erie, must secure the required depth wholly by deepening, while the profiles of the levels from Lockport east can be adjusted to meet the economical requirements that will be disclosed by detailed surveys.

The first level from Buffalo to Lockport will be 32 miles long. Descending from this level at Lockport, by two locks, each of about 25 feet

lift, the second level of the canal will be reached. This level, 64 miles in length, will extend to Brighton, where, descending by two locks of about 24 feet lift, we reach the third level of the canal, extending from Brighton to Macedon, 20 miles, there descending by a lock of about 20 feet lift, we reach the fourth level, extending from Macedon to Newark, 12 miles; where, by a lock of about 20 feet lift, is reached the level of the proposed new canal, to extend from Newark to Utica, about 115 miles, which will be the fifth and longest level of the new canal. From that point the Mohawk River (except at Little Falls and Cohoes, where combined locks will be required) can best be canalized through locks of 10 or 12 feet lift, making pools having an average length of about 5 miles each.

The construction of this great artificial river, more than 300 miles long, involving as it does so vast a structure, which must be built in a manner to attain absolute security and permanence; the acquisition of large areas of land; the maintenance of the drainage of the country it traverses, and the erection of swing bridges at all necessary crossings, is a vast enterprise, both in engineering and in finance. It is a problem, however, that cannot be accurately stated even, either in a financial or in an engineering sense, until detailed surveys furnish data for detailed plans and estimates, and until a careful compilation of industrial statistics furnish the means of judging the volume of tonnage it will probably command. Judged by the cost of similar undertakings and what is already known of this route, its cost may be roughly assumed at 125 to 150 millions of dollars, and from the commercial statistics at hand its probable tonnage may be placed at 20 to 25 millions tons per annum.

The first requisite to the possible inauguration of this enterprise is, of course, a careful system of surveys that will determine its probable cost, and whether it be undertaken by private enterprise, as most of the great artificial transportation lines of the world have been, by the aid of the National Government, or by the State itself, every consideration of State interest and State pride requires that it should remain forever under the sovereign control of the Empire State, and she should, without delay, cause the necessary surveys and estimates to be made for determining all the elements of this problem.

Let us consider the importance of this waterway. For the past four years the average grain rates from Chicago to New York during the season of navigation have been by rail $14\frac{9}{10}$ cents, by lake to Buffalo and

thence by rail to New York, $12\frac{1}{10}$ cents, and by lake and canal to New York, $9\frac{9}{10}$ cents per bushel.

The large propellers of the lakes have, however, during this period, found a profit in carrying grain from Chicago to Buffalo at 2 cents a bushel, while the cost by canal from Buffalo to New York, though the distance is only half as great, without tolls, but including the cost of transfer, has, at the same time, been more than 4 cents per bushel, more than twice the cost, and more than twice the time in transit for one-half the distance.

In the enlarged canal, making due allowance for reduced speed in the narrow channel and for lock detentions, the propeller would make the trip from Buffalo to New York in as short a time as she requires between Chicago and Buffalo, and thus deliver her cargo from Chicago to New York in less time and at less cost than can now be done by canal from Buffalo to New York. Such a realization would establish the commerce of New York on an enduring basis, never to be shaken by any development of trade, or combination of circumstances, that now seem possible.

All the great railway systems of the west, north of Arkansas and Texas, terminate at lake ports, and their prosperity and very existence depend on the diversion of all the business they can control to these ports, and with this canal enlarged, all the heavy freights that reach those ports, bound east, are destined by the laws of trade to take the water route, as being cheaper than any rail transit yet dreamed of.

Within the net-work of these railway lines, or grouped about the great lakes themselves, lay the great grain fields of the country, its principal forests and mines, as well as the chief part of its inland cities.

They must all become tributary to this canal if enlarged, and offer in commodities suited to canal transportation a larger volume of tonnage than the world has ever seen concentrated on an artificial line of transportation.

The importance of this enterprise increases with the rapid growth of our population and the consequent changing social and economic conditions of the country. Our productive capacity is beginning to exceed the demand. Our foreign grain markets are threatened with new competition from India and Australia.

If our national prosperity is to continue, we must reach foreign markets with our manufactures, and thus, by increasing the manufacturing class, create new home demands for our surplus food.

To reach these markets we must cheapen the goods by lessening the cost of living to the operatives, and also the cost of bringing together the raw materials requisite to manufacturing processes, and of sending the manufactured products to market.

With our wide-spread territory, cheap transportation is the chief agency in effecting these economies, and the Erie Canal, joining the granaries, the mines and the forests of the West, with the manufactories of the East, should be endowed with the necessary capacity to effectually realize the ideal of the political economist as to transportation.

I have thus crudely presented the salient features of this problem to my professional brethren, in the belief that it must soon become an urgent engineering question, and trusting that they will give it thorough consideration and aid in giving it intelligent form, and, if found worthy, in commending it to popular appreciation.

## DISCUSSION.

By E. L. Corthell, E. P. North, Willard S. Pope, O. M. Poe, M. M. Drake, A. P. Boller, E. H. Walker, E. S. Chesbrough, W. W. Evans, T. C. Clarke, N. M. Edwards, W. E. Merrill, John D. Van Buren, Jr., D. Farrand Henry, O. Chanute, Clemens Herschel, J. Nelson Tubbs, T. C. Keefer, Simon Stevens, Robert L. Harris, Theodore Cooper, F. Collingwood and E. Sweet.

E. L. Corthell, M. Am. Soc. C. E.—The execution of the project presented in this paper is improbable, either in the near or the distant future, and thus far is the interest and importance of the paper lessened.

We do not go backward in this country or in this age. We progress always. Newly discovered laws in nature, useful inventions, new appliances, new adaptations of physical forces lead us onward whether we will or no. Cheapness, quickness and systematic regularity in business and work are in demand. That method that will most completely combine these essential qualities is adopted, whether in construction, business, or commerce, and in time it will supersede all inferior and ancient methods, regardless of what they cost or the good they may have done in a prior generation.

Certain districts of this country abound in abandoned artificial water-ways. The railway has dried up the bed of the canal, broken down the locks, and, in some cases, monopolized the banks or bed for its rails.

Some railway companies, like the Delaware & Hudson Canal Company, although originally the proprietors of canals *only*, have gradually replaced them with railways, and the canals still in operation are doomed to the fate of the others.

Had the Erie Canal been the property of a railway company it would have been abandoned long ago, and a railway would have been laid on its tow-path or in its bed. That canal and its branches has served a good purpose in the early development and prosperity of the country, but the object for which it was built and operated for many years has been accomplished; the reasons for an artificial water-way have gone forever, and a better servant of man has taken its place. We also take the

ground that there is no more need of a ship canal between Buffalo and New York than there is for the present canal.

In the discussion of this subject it is necessary to inquire whether all the grand results attributed to the Erie Canal rightfully belong to it.

What did it accomplish before the advent of railroads in reducing the cost of transportation between the Great Lakes and New York City, and, by this reduction, developing the Northwest and enriching its eastern terminus? We answer—nothing.

It was not till 1868 that the trunk line managers believed it would pay to haul grain from the West. Prior to that time, back to 1857, the charge per bushel for wheat from Chicago to New York, via lake and canal, was 25¼ cents. There was during this time no gradual diminution in rates; there was no competition, and it is probable that the above rate would have ruled to this day had not another means of transportation come in as a competitor. The records show an increase, if anything, in rates, for in 1858-9 the rate was 18 cents, and in 1866, 31½ cents.

But when the railroads commenced to haul grain and compete with each other and the canal, it then, and not till then, commenced a reduction in its rates, holding them about 2 cents per bushel below the rail rates. When it became evident that the boatmen could not haul the freight and compete with the railroads, the State stepped in and gave them relief by abolishing the tolls and saddling the people at large with the cost of maintenance and operation.

The rates have, since 1868, dropped to about 8 cents for lake and canal, and to 10 cents for lake and rail, and to 14 cents for all rail rate, or about 5 mills per ton per mile. The trunk lines are now hauling freight from Chicago to New York at 15 cents per hundred pounds, or 3 *mills per ton per mile.* Only three or four years ago many railroad men contended that it could not be hauled, and never would be, at 1 cent per ton per mile. It should be stated that the reduction in rates was not due to canal competition at all, but to the very active competition that existed among the three main trunk lines of railroads, all striving for the business.

How slight the effect of the canal has been is shown by the fact that the tonnage transported per annum on the New York State canals has not varied much from five and a half million tons since 1868. In 1869 the amount was 5 896 080 tons, and in 1883, 5 664 050 tons. *No* one will contend that during all this time the canal was worked to its utmost

capacity. The complaint has all the while been that there was no business to pay the owners of the boats for running them, much less to pay for the building of new boats to take the place of those worn out by age or service.

The reason has been that, even at a slight advance in rates, shippers preferred to ship by rail, probably for two very important reasons: first, the saving of time, three days by rail against ten days by canal; and second, the systematic regularity through the entire year by railroad transportation, so that in 1883, while the canal was carrying its regular quota of five and a half million tons, the New York Central, a parallel line of transportation, carried nearly eleven millions, the Erie Railroad and the New York State line nearly fourteen millions, and the Pennsylvania Railroad, an all rail route, nearly twenty-two millions, an amount of freight equal to that expected through the ship canal under discussion.

There is no doubt that the railroads can carry through freight cheaper than canals can afford to do, if the interest on invested capital is not taken into account, and this, with *time*, and *convenience* and *regularity*, is the only correct basis on which to consider this important subject. For, if a straight-lined, low-grade railroad, like the New York, West Shore & Buffalo, can transport freight at less cost than the canal, interest not considered, then let us propose to the State or to the Government of the United States to build a railway, or buy the West Shore, remove all charges for capital invested, and run the road and transport the freight for the people at a minimum cost, and abandon the old canal. This plan would be much more acceptable to them than any artificial water-way.

This will become evident if we will for the moment assume that the railroads are not in existence, and the alternative is then before the country of having an artificial water-way, obstructed by locks, and available for transportation for only one-half of each year, and even during these months hauling freight at a rate of speed most aggravating for the rapid rate of general business; or, on the other hand, a well-equipped railway, capable of handling as much freight as the canal, but doing it regularly, promptly and cheaply, and in accordance with the methods of business that have been introduced and established by the railway, telegraph, ocean cable, the modern newspaper, and all other means of quick communication between cities, states, countries and continents. When the oceans are whispering galleries for the business of the nations we are

not willing that our freights shall drag snail-like the whole length of the Empire State.

Let us now consider briefly the ship canal project of the paper under discussion :

There is only one ship canal in operation of any magnitude in the world, and that is not similar to the one under discussion, nor is it so extensive, or on so grand a scale. I refer to the Suez Canal.

It has been considered one of the wonders of the world, and its projector and builder has received very justly the plaudits of mankind ; but it pales before the Buffalo and Troy Ship Canal.

The length of the Suez Canal is 100 statute miles, 39 miles only of which is through cuttings above the surface of the water, while 61 miles is through the lakes. It has a breadth of from 190 to 330 feet. It has no lock from one end to the other, its minimum radius is 2 000 feet, and yet under all its advantages for quick transit the average stay of a steamer in the canal between Suez and Port Said is 50 hours, in which is included the effective steaming time, the delays by occasional grounding and sheering against the banks, the passing of other vessels and other incidental delays.

Contrast this with the Buffalo and Troy Ship Canal, whose length is 345 miles. Take the same average rate, including the same kind of stops as those in the Suez Canal, that is two miles per hour, then add to the time required for passage in the open canal, the delays in passing through 37 locks, and we have the total time required of 200 hours, or 8⅓ days, operating day and night.

Now, compare the present canal with the future ship canal in regard to the cost of moving freight. A boat load of grain (250 tons) is now moved by two mules and a boy, and the boat is cheaply constructed and without machinery or expensive appointments.

In the ship canal, a steamer, whose first cost is about $90 000, must spend eight days or more in the canal before reaching deep water, or an unobstructed water-way. She transports 40 000 bushels of grain as against 8 000 of the canal boat, or five times as much ; but it costs more than five times as much to transport it, or probably three cents to four cents per bushel.

The cost of transporting freight in the ocean or the great lakes by steam or sail is, of course, much less than by railroad. On long voyages it is considered to be about three times cheaper than by rail ; but on

ocean or lake the steamer moves at will, where and how she likes—it is Nature's, not man's, great highway of commerce—her speed is from ten to fifteen miles per hour; she takes advantage of the winds and currents, and takes the quickest route to her port; but in a ditch, and in that ditch impeded by locks and other vessels, and liable at any time, if she attempt to increase her speed, to ground upon the bottom or sides of the canal, the case is entirely different.

It is therefore very doubtful if wheat can be placed in New York City from Buffalo any cheaper by ship canal than by rail—a first-class, low-grade, four-track railway, fully equipped with the best and most approved equipment.

The interruption to business and the disorganization consequent upon the ship canal being closed by ice for half the year will be most serious to its interests. The lake steamers that now bring the grain and other heavy freights to the canal and railroads at Buffalo and other ports, must be doubled, probably trebled, in number to make the through trip to New York City. At the approach of winter these steamers must lay up for the winter, but the interest on the cost and the expense of caring for them through the winter goes on, and must be met the next season by an advance in the rates.

We are not sufficiently posted in the progress of the Canadian Ship Canals to quote them, but all the vast sums expended so far by the Canadian Government on its artificial water-ways, do not seem to have been productive of great results. The receipts of grain at Montreal show a considerable decrease in the last eleven years. The receipts in 1873 were 19 713 529 bushels, and in 1884, 18 063 594 bushels, and in 1883, 16 049 175 bushels. While Boston, reached by rail alone, received in 1873, 17 926 202 bushels, and 1884, 36 985 430 bushels. And Baltimore, also reached by rail, increased from 19 099 517 bushels to 33 301 281 bushels.

The facts above stated, and this very brief review of the subject, go to prove that neither agriculture, manufactures nor commerce require an artificial water-way, and that railways have subserved and will still more fully subserve all purposes, and meet all future demands.

Were continents to be united as by the Suez Canal, or continents and oceans, as by our own interoceanic projects, the subject would be worthy of earnest consideration.

In regard to the practicability of constructing such a ship canal as

the paper proposes, and the ability to overcome the many serious difficulties that lie in the way, we do not question it. This age can accomplish anything that man desires or demands for his necessities, use and convenience.

The civil engineer of to-day should be daunted by no project, however stupendous. The only question for him to settle before throwing himself into the work with all his might, is its necessity or utility. That question answered satisfactorily, let him stand aside for no obstacle.

The able engineer who wrote the paper under discussion is fully equal to the task before him in the construction of this great work, but he will, in our judgment, never be asked to perform it.

If the time ever comes when a more complete means of transportation is demanded than can be supplied by the ordinary railway, we will be glad to suggest a solution of the problem in a ship and barge railway. This can be built for half the cost of the proposed ship canal, from deep water in the lakes to deep water in the Hudson. It can be operated and maintained at less cost than the canal, employ a rate of speed five times as great as is possible in the canal, can be operated for the whole twelve months of the year instead of six, or during the lake navigation, like the ship canal; will require no breaking bulk, and through freight can be hauled over it at 2½ mills per ton per mile, or 2½ cents per bushel of wheat.

To follow this suggestion still further, another or fifth track added to the present four tracks of the New York Central Railroad would accommodate this business with slight comparative expense in construction. In other words, make a five-track road; two, as now, to be used for passengers, and three for ordinary freight, the steamer and barge railway, the barges to be hauled on two tracks and the steamers on three. The flattening of some of the grades and curves, the rebuilding of the bridges (which need rebuilding as it is), the lengthening of abutments and culverts and the widening of the embankment, could all be easily and economically done.

The careful study of the whole subject during the last five years in connection with the Tehuantepec Ship Railway, the appliances invented and arranged for lifting, handling, hauling and turning vessels, shows that in first cost, in operation and maintenance, and in its great and many conveniences and economies, the ship railway is the correct plan to adopt when continents and oceans are to be united, or the cost

of transportation is to be reduced and time saved for the use and convenience of man.

We venture to assert that this method will revolutionize the transportation business, and solve many problems, such as the one underlying the paper under discussion.

The following table gives a comparative statement of the receipts and exports of grain for 1873 and 1883, at the ports of New York, Boston, Philadelphia, Baltimore and Montreal. It goes to prove that the railways are doing the business even for foreign exports, against the competition of the great Canadian system of artificial and natural water-ways, though that system was the shortest route, and possessed great natural advantages over even the projected Erie Ship Canal.

COMPARATIVE STATEMENT OF RECEIPTS AND EXPORTS OF GRAIN AT THE PORTS OF NEW YORK, BOSTON, PHILADELPHIA, BALTIMORE AND MONTREAL. IN TONS OF 2 000 POUNDS.

TABLE No. 1.

| | Receipts. | | Exports. | | Ratio of Increase or Decrease, 1873-'83. | Ratio of Exports to Receipts. |
|---|---|---|---|---|---|---|
| | 1873. | 1883. | 1873. | 1883. | | |
| | Tons. | Tons. | Tons. | Tons. | Per cent. | Per cent. |
| New York..... | 2 764 000 | 3 714 000 | 1 370 000 | 1 813 000 | Inc. 34 | 49 |
| Boston ..... | 538 000 | 1 192 000 | 150 000 | 327 000 | Inc. 122 | 27 |
| Philadelphia .. | 741 000 | 678 000 | 320 000 | 289 000 | Dec. 8½ | 43 |
| Baltimore..... | 573 000 | 1 075 000 | 380 000 | 720 000 | Inc. 88 | 67 |
| Montreal. .... | 591 000 | 481 000 | 280 000 | 226 000 | Dec. 19 | 47 |
| | | | | | Average .. | 47 |

NOTE.—The exports include only the three main articles: Wheat, wheat-flour and corn. The amounts are put at the nearest thousand. They are furnished by the Railroad Gazette, January 30, 1885, p. 73; by Mr. Joseph Nimmo, Jr., Chief of the U. S. Bureau of Statistics, and by Mr. E. H. Walker, Statistician of the New York Produce Exchange.

EDWARD P. NORTH, M. Am. Soc. C. E.—On the completion of the Erie Canal in 1825, a boat carrying 60 tons, at the rate of 1½ miles per hour, was a very great improvement over a wagon carrying one ton 20 miles per day—an improvement that earned for the State of New York its title of Empire State, and made its port *the* port of our country. On the completion of the enlargement of the canal, commenced August, 1836 and finished September, 1862, the boats were increased in size to a burden of 240 tons, and they have remained without other increase in efficiency over that attained in 1825.

In the meantime, the capacity of freight trains, which in 1850, on the New York Central Railroad, was 25 cars, carrying 8 tons each, and on the Hudson River Railroad 30 to 32 cars, carrying also 8 tons, has been increased by well-known appliances, till 1 131 tons of paying freight have been brought from Buffalo to New York in one train. The deepening of the Lake harbors, and the St. Clair Flats, with improvements in Lake navigation, has kept pace with the increased capacity of the railroads, but no increase in the value of the canal as an agent of distribution has been made, so that, as will be seen from Table No. 2, covering sixteen years, the freight carried on it has fallen not only relatively, but absolutely to the amount of nearly 800 000 tons, while the total freight transported by the canals, and the New York Central, Erie and Pennsylvania Railroads has risen from 16 919 082 in 1868 to 51 841 279 tons in 1883.

## TABLE No. 2.

FROM REPORT ON FOREIGN COMMERCE OF THE UNITED STATES FOR 1884, BY JOSEPH NIMMO, JR., CHIEF OF BUREAU OF STATISTICS.

Total number of tons (2 000 pounds) transported upon the New York State canals, the New York Central and Hudson River Railroad, the New York, Lake Erie and Western Railroad, and the Pennsylvania Railroad each year from 1868 to 1882, inclusive:

| YEAR. | New York State Canals. | New York Central and Hudson River Railroad. | New York, Lake Erie and Western Railroad. | Pennsylvania Railroad Division. | TOTAL. |
|---|---|---|---|---|---|
| | *Tons.* | *Tons.* | *Tons.* | *Tons.* | |
| 1868 | 6 442 225 | 1 846 599 | 3 908 243 | 4 722 015 | 16 919 082 |
| 1869 | 5 859 080 | 2 281 885 | 4 312 209 | 5 402 991 | 17 856 165 |
| 1870 | 6 173 769 | 4 122 000 | 4 852 505 | 5 804 051 | 20 952 325 |
| 1871 | 6 467 888 | 4 532 056 | 4 844 208 | 7 100 294 | 22 944 446 |
| 1872 | 6 673 370 | 4 393 965 | 5 564 274 | 8 459 535 | 25 091 144 |
| 1873 | 6 364 782 | 5 522 724 | 6 312 702 | 9 211 231 | 27 411 439 |
| 1874 | 5 804 588 | 6 114 678 | 6 364 276 | 8 626 946 | 26 910 488 |
| 1875 | 4 859 858 | 6 001 954 | 6 299 946 | 9 115 368 | 26 217 126 |
| 1876 | 4 172 129 | 6 803 680 | 5 972 818 | 9 922 911 | 26 817 538 |
| 1877 | 4 955 963 | 6 351 356 | 6 182 451 | 9 738 295 | 27 228 065 |
| 1878 | 5 171 320 | 7 695 413 | 6 150 568 | 10 946 752 | 29 964 053 |
| 1879 | 5 362 372 | 9 015 753 | 8 212 641 | 13 684 041 | 36 274 807 |
| 1880 | 6 457 656 | 10 533 038 | 8 715 892 | 15 364 788 | 41 071 374 |
| 1881 | 5 179 192 | 11 591 379 | 11 086 823 | 18 229 365 | 46 086 759 |
| 1882 | 5 467 423 | 11 330 393 | 11 895 238 | 20 360 399 | 49 053 453 |
| 1883 | 5 664 056 | 10 892 440 | 13 610 623 | 21 674 160 | 51 841 279 |

The cost of transporting a bushel of wheat from Chicago to New York from 1857 to 1884, is shown in Table No. 3, and the grain rates by railroad for twenty years in Table No. 4.

## TABLE No. 3.

SHOWING AVERAGE FREIGHT CHARGES FROM CHICAGO TO NEW YORK, PER BUSHEL OF WHEAT.

First 3 columns from Nimmo's "Report on Foreign Commerce of the United States, 1884." Second 2 columns from "A Sketch of the Commerce, &c., of Buffalo," by Wm. Thurston, Secretary Merchants' Exchange, and last 3 from "Report of Auditor of New York Canals, 1881."

| CALENDAR YEAR. | AVERAGE RATES PER BUSHEL. | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | By Lake and Canal.* | By Lake and Rail. | By all Rail. | By Lake. | By Canal. | Lake Freights. | Canal Freights. | Canal Tolls. |
| | *Cents.* | *Cents.* | *Cents.* | *Cents.* | *Cents.* | *Cents.* | *Cents.* | *Cents.* |
| 1857 | 26.03 | | | | | | | |
| 1858 | 17.03 | | | | | | | |
| 1859 | 18.33 | | | | | | | |
| 1860 | 25 58 | | | | | | | |
| 1861 | 27.05 | ..... | ..... | ..... | ..... | 11.53 | 15.75 | 5.17 |
| 1862 | 27.08 | ..... | ..... | ..... | ..... | 10.49 | 15.84 | 6.21 |
| 1863 | 23.65 | ..... | ..... | ..... | ..... | 7.51 | 15.39 | " |
| 1864 | 29.11 | ..... | ..... | ..... | ..... | 9.58 | 18.78 | " |
| 1865 | 28.37 | ..... | ..... | ..... | ..... | 9.78 | 16.84 | " |
| 1866 | 31.36 | ..... | ..... | ..... | ..... | 13.40 | 16.96 | " |
| 1867 | 24.11 | ..... | ..... | ..... | ..... | 6.67 | 13.32 | " |
| 1868 | 24.54 | 29.0 | 42.6 | ..... | ..... | 7.14 | 15.65 | " |
| 1869 | 23.12 | 25.0 | 35.1 | ..... | ..... | 6.81 | 16.31 | " |
| 1870 | 17.10 | 22.0 | 33.3 | ..... | ..... | 5.88 | 11.22 | 3.10 |
| 1871 | 20.24 | 25.0 | 31.0 | ..... | ..... | 7.62 | 12.62 | " |
| 1872 | 24.50 | 28.0 | 33.5 | ..... | ..... | 11.15 | 13.10 | " |
| 1873 | 19.19 | 26.9 | 33.2 | ..... | ..... | 7.62 | 11.57 | " |
| 1874 | 14.10 | 16.9 | 28.7 | 3.9 | 10.0 | 4.03 | 10.11 | " |
| 1875 | 11.43 | 14.6 | 24.1 | 3.5 | 7.9 | 3.42 | 8.01 | 2.07 |
| 1876 | 9.58 | 11.8 | 16.5 | 2.9 | 6.6 | 3.11 | 6.72 | " |
| 1877 | 11.24 | 15.8 | 20.3 | 3.7 | 7.4 | 3.57 | 7.39 | 1.03 |
| 1878 | 9.15 | 11.4 | 17.7 | 3.1 | 6.0 | 3.17 | 5.99 | " |
| 1879 | 11.60 | 13.3 | 17.3 | 4.7 | 6.8 | 4.72 | 6.96 | " |
| 1880 | 12.27 | 15.7 | 19.7 | 5.7 | 6.5 | 5.70 | 6.50 | " |
| 1881 | 8.19 | 10.4 | 14.4 | 3.2 | 4.7 | 3.40 | 4.88 | " |
| 1882 | 7.89 | 10.9 | 14.6 | 2.5 | 5.4 | | | " |
| 1883 | 8.40 | 11.5 | 16.5 | 3.5 | 4.9 | | | 0.00 |
| 1884 | 6.60 | 9.75 | 13.0 | 2.1 | 4.2 | | | 0.00 |
| | | | | 3.53 | 6,4 | | | |

* Including Buffalo transfer charges and tolls.

This is a great improvement over the $100 per ton charged for transportation from Albany to Buffalo before the completion of the canal.

## TABLE No. 4.

[From *Railroad Gazette*, January 9th, 1885.]

CHICAGO-NEW YORK GRAIN RATES FOR 20 YEARS.

(In cents per 100 lbs.)

| Date. | Rate. |
|---|---|
| 1864. | |
| Mar. 28 | 100 |
| April 4 | 90 |
| April 12 | 80 |
| April 14 | 75 |
| July 11 | 80 |
| July 22 | 85 |
| July 28 | 80 |
| Sept. 7 | 90 |
| Sept. 10 | 95 |
| Nov. 12 | 100 |
| Nov. 16 | 115 |
| Nov. 28 | 125 |
| Dec. 13 | 138 |
| Dec. 24 | 160 |
| 1865. | |
| Jan. 1 | 160 |
| April 22 | 100 |
| May 15 | 70 |
| Sept. 6 | 62½ |
| Sept. 11 | 70 |
| Sept. 27 | 77½ |
| Oct. 10 | 85 |
| Oct. 17 | 95 |
| Oct. 27 | 105 |
| Nov. 2 | 115 |
| Nov. 7 | 120 |
| Nov. 9 | 130 |
| 1866. | |
| Jan. 1 | 130 |
| Jan. 9 | 80 |
| Feb. 26 | 70 |
| May 11 | 55 |
| June 7 | 60 |
| July 5 | 65 |
| Sept. 18 | 75 |
| Sept. 27 | 85 |
| Oct. 10 | 90 |
| Oct. 15 | 100 |
| Nov. 5 | 105 |
| Dec. 8 | 90 |
| 1867. | |
| Jan. 1 | 90 |
| Feb. 7 | 80 |
| Mar. 4 | 70 |
| Mar. 22 | 60 |
| April 15 | 50 |
| June 8 | 75 |
| June 21 | 70 |
| Sept. 2 | 75 |
| Sept. 23 | 85 |
| 1868. | |
| Jan. 1 | 85 |
| Sept. 1 | 60 |
| Sept. 7 | 65 |
| Sept. 14 | 70 |
| Dec. 6 | 75 |

| Date. | Rate. |
|---|---|
| 1869. | |
| Jan. 1 | 75 |
| Jan. 25 | 70 |
| Mar. 11 | 50 |
| 1870. | |
| Jan 1 | 50 |
| Jan. 22 | 55 |
| Mar. 4 | 50 |
| Mar. 22 | 45 |
| May 23 | 40 |
| Aug. 29 | 45 |
| Aug. 31 | 50 |
| Oct. 31 | 55 |
| Nov. 22 | 60 |
| 1871. | |
| Jan. 1 | 60 |
| Mar. 4 | 50 |
| April 7 | 45 |
| June 26 | 40 |
| July 10 | 45 |
| Aug. 11 | 50 |
| Sept. 21 | 55 |
| Oct. 2 | 60 |
| Oct. 25 | 65 |
| 1872. | |
| Jan. 1 | 65 |
| Mar. 25 | 60 |
| May 1 | 50 |
| Aug. 26 | 45 |
| Sept. 2 | 50 |
| Sept. 9 | 55 |
| Sept. 16 | 60 |
| Oct. 14 | 65 |
| 1873. | |
| Jan. 1 | 65 |
| April 14 | 60 |
| May 20 | 45 |
| Sept. 5 | 50 |
| Nov. 20 | 55 |
| Dec. 8 | 60 |
| 1874. | |
| Jan. 1 | 60 |
| Feb. 3 | 55 |
| April 15 | 40 |
| May 6 | 45 |
| Dec. 11 | 40 |
| 1875. | |
| Jan. 1 | 40 |
| Oct. 1 | 30 |
| Oct. 12 | 40 |
| Dec. 1 | 45 |
| 1876. | |
| Jan. 1 | 45 |
| Mar. 7 | 40 |
| April 13 | 35 |
| April 26 | 22½ |
| May 5 | 20 |
| Dec. 18 | 30 |

| Date. | Rate. |
|---|---|
| 1877. | |
| Jan. 1 | 30 |
| Jan. 2 | 35 |
| April 2 | 30 |
| Sept. 4 | 35 |
| Oct. 17 | 40 |
| 1878. | |
| Jan. 1 | 40 |
| Mar. 11 | 30 |
| April 1 | 25 |
| May 17 | 20 |
| Aug. 5 | 25 |
| Aug. 17 | 30 |
| Nov. 25 | 35 |
| 1879. | |
| Jan. 1 | 35 |
| Feb. 1 | 20 |
| Mar. 1 | 18 |
| April 1 | 15 |
| May 1 | 10 |
| June 9 | 15 |
| June 22 | 20 |
| Aug. 4 | 25 |
| Aug. 25 | 30 |
| Oct. 13 | 35 |
| Nov. 10 | 40 |
| 1880. | |
| Jan. 1 | 40 |
| Mar. 1 | 35 |
| April 14 | 30 |
| Nov. 27 | 35 |
| 1881. | |
| Jan. 1 | 35 |
| Feb. 1 | 40 |
| Mar. 1 | 35 |
| April 1 | 30 |
| April 11 | 25 |
| April 18 | 30 |
| June 8 | 25 |
| June 15 | 12 |
| Sept. 26 | 15½ |
| Oct. 10 | 15 |
| Nov. 1 | 20 |
| Dec. 9 | 12½ |
| 1882. | |
| Jan. 1 | 12½ |
| Jan. 28 | 20 |
| Mar. 25 | 25 |
| Dec. 1 | 30 |
| 1883. | |
| Jan. 1 | 30 |
| April 19 | 25 |
| Nov. 26 | 30 |
| 1884. | |
| Jan. 1 | 30 |
| Jan. 5 | 20 |
| Jan. 14 | 30 |
| Mar. 14 | 20 |
| Mar. 21 | 15 |
| June 24 | 20 |
| July 21 | 25 |

Mr. Dunning, Editor of the *Railroad Gazette*, says for the earlier years covered by this table: "The regular rate, doubtless, did not so nearly represent the actual rate in those days as it does now, when there is no great disturbance. Irregularities which were common and expected then would not be thought permissible now, and we know that there are now considerable deviations from regular rates that do not result in an open rupture, and of which there is no trace in a file of published rates—as, for instance, since last July."

And he speaks generally of the tables as follows:

"We should say that for 1879 and 1881 we have given in the record figures representing approximately the actual rates charged instead of schedule rates, which are known not to have been observed."

"Down to 1879 the rates were quoted in a depreciated and fluctuating currency, which at times made them very much greater than if they had been in the present standard gold currency. The rates are truly very much less now than they used to be; but the decline since 1865 has been not nearly so great as the figures make it appear. For instance, when the $1.60 rate was made, December 24, 1864, gold was at a premium of about 122 per cent., and the $1.60 in currency would bring but 72½ cents in gold. The decline from 72½ cents then to 25 cents now is truly a great one, but it is not properly 84 per cent., as would appear from the currency figures, but less than 66 per cent. The lowest rate of 1864, 75 cents, was made when gold was 175, and amounted to but 43 cents in gold—large in proportion to the 15-cent rate at the same time last year, but not 187 per cent. greater, as appears from the schedule figures. To check the effect of the premium on gold, we give below the *gold value* of the highest and lowest rates in each year *at the time the rates were made* down to the time of the disappearance of the premium on gold, in cents:

| Year. | Highest. | Lowest. | Year. | Highest. | Lowest. |
|---|---|---|---|---|---|
| 1864 | 60 | 43 | 1872 | 60 | 40 |
| 1865 | 83 | 43 | 1873 | 58 | 38 |
| 1866 | 83 | 43 | 1874 | 54 | 36 |
| 1867 | 68 | 37 | 1875 | 38 | 27 |
| 1868 | 64 | 41 | 1876 | 40 | 18 |
| 1869 | 55½ | 38 | 1877 | 39 | 29 |
| 1870 | 53 | 35 | 1878 | 39 | 20 |
| 1871 | 58 | 36 | | | |

"Thus from the end of the war to the close of 1878 both highest and lowest rates had been reduced something more than one-half.

"Since 1878, during a period when there has been an organization of the railroad companies to prevent the irregular reduction of rates, the highest and lowest in each year have been:

| Year. | Highest. | Lowest. | Year. | Highest. | Lowest. |
|---|---|---|---|---|---|
| 1879 | 40 | 10 | 1882 | 30 | 12½ |
| 1880 | 40 | 30 | 1883 | 30 | 25 |
| 1881 | 40 | 12½ | 1884 | 30 | 15 |

"Thus in the last three years the highest winter rate has been one-fourth less than in the three years previous; and now, in 1885, we have a winter rate of 25 cents—still lower than any heretofore established for the winter.

"We find that with navigation closed they made a rate of 40 cents in the fall of 1879, 35 in 1880, 30 in 1882 and 1883, and 25 in 1884; and meanwhile the summer rate which they have desired to make has fallen from 30 to 25 cents—certainly as great a cheapening of one of the greatest elements in the cost of production as the most sanguine could have hoped for.

"But it is evident that there can be no such reduction of rates hereafter. The charge having fallen from 83 to 25 cents, there is little room left for it to fall. Nowhere else on earth are rates so low; and whatever reduction in working expenses may be made hereafter, it cannot make it possible to reduce a charge of 25 cents by 58, 40, or even 25 cents.

"It is probable, indeed, that it will be long before there is any reduction. A 25-cent rate leaves so small a margin over the cost of transportation that there will be little interest in securing traffic if there is a further reduction."

Capt. M. M. Drake, in his discussion of Mr. Sweet's paper, says: "Thirty years ago our largest craft for transporting freight did not exceed 20 000 bushels, or 600 tons." Now 100 000 bushels or 3 000 tons is the maximum. Then the depth on the St. Clair Flats was 9½ feet; now it is 16 feet. The depths, according to Gen. Poe (see his letter in this discussion), have been to 1858, 9½ feet; to 1871, 12 feet; to 1874, 13 feet; and to the present time, 16 feet.

Capt. Clinton B. Sears, in his paper, read before the Society, on Tidal Harbor Improvements (Vol. V, p. 394), says: "High authorities now

agree that the capacities for tonnage, of different channels, vary as the cubes of their depths." In this case the increased tonnage seems to have followed the ratio given very closely. The average yearly receipts of grain at Buffalo, not including that brought by the Lake Shore Railroad, from 1836, according to Mr. Thurston's "Sketch" during the above periods, were as follows:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 23 | years, | 1836–'58, | 9½ | feet | water, | average per year, | 12 549 329 bushels. |
| 13 | " | 1859–'71, | 12 | " | " | " | 51 796 826 " |
| 3 | " | 1872–'74, | 13 | " | " | " | 68 642 459 " |
| 9 | " | 1875–'83, | 16 | " | " | " | 73 383 129 " |

The same is given by decades:

| | |
|---|---|
| 1836–'45 | 4 185 144 " |
| 1846–'55 | 17 471 744 " |
| 1856–'65 | 43 239 032 " |
| 1866–'75 | 59 712 167 " |
| 1876 to and including 1883 | 73 275 180 " |

Many schemes have been broached for the improvement, or otherwise, of the canal—such as lengthening the locks to allow the passage of two or more boats, increasing the depth one foot, using tugs, placing a narrow gauge railroad track on each bank for towing, employing the Belgian cable system; and, lastly, building a double-track railroad in the bed of the canal.

Commissions on the improvement of the canal, appointed from time to time, have overlooked the very obvious expedient of feeding the canal from Lake Erie, as proposed by Mr. Sweet, and it has been generally understood that no radical enlargement of the canal was possible without recourse to pumping. Thus, fortunately, the way is left unobstructed by minor improvements or half-way measures for an enlargement to a scale necessary to handle with speed a traffic of over 50 000 000 tons per annum—that is, doubling from our own resources every ten years, to say nothing of the freight to be added, to and from the country opened by the Canadian Pacific Railroad, all of which should pass through this country, affording us the advantages, both from freight and exchange, claimed by Geo. J. Goschen in his "Theory of the Foreign Exchanges," as follows:

"The effect of profits and commissions on the mutual liability of nations is much the same as that exercised by interest. Among such

profits we may class the freights earned by ships of various countries; the country which becomes the carrier for others establishing claims against them by which it can pay for its importations from them.

"The charge for freight acts with the same force as a charge for a commodity actually produced and exported. An exclusively maritime country could discharge its obligations to other countries which supply it with necessaries simply by becoming their carrier, without exporting any produce or manufacture to them in return.

"A favorable position may enable one nation to make others its debtors for various tributes and commissions. A country which mediates the transactions of many others, and through its position as a great banking and mercantile center is able to secure some slight commission or profit upon all the operations it assists in conducting, derives no inconsiderable revenue from this source.

"The interest and commissions which are still paid by almost every country to English capitalists certainly form a noticeable element in the revenue by which England is enabled to discharge her enormous foreign liabilities."

The *Cologne Gazette* claims that Germany pays yearly to England $36 515 000 on her commerce, passing through English hands, distributed as follows: Freight, $18 000 000; agents' commissions, $14 000 000; insurance, &c., $4 515 000.

It is not intended at this time to discuss the technical points that will be involved in the construction and maintenance of the proposed canal, but rather to examine the question of its necessity, the resources for its construction, and the probability of its proving remunerative to our country when completed.

Arguments are not required to show that the route by the lakes and Erie Canal, though no longer the chief factor in the distribution of freight, is a controlling factor in the price received for that service. And it will be seen by referring to Table No. 3, that for the past 11 years the freight charges per bushel on wheat, from Chicago to Buffalo, 905 miles, have averaged $3\frac{53}{100}$ cents = $\$1.17\frac{67}{100}$ per ton, or $1\frac{3}{10}$ mills per ton-mile. At this rate per ton-mile the canal and river freight, 495 miles, would have been $1\frac{83}{100}$ cents per bushel, against $4\frac{55}{100}$ cents, the average for the two years that no toll has been charged on the canal.

With the enlargement a boat should not take more time to pass through the canal and river than through the lakes. Nor, with the canal

free, should the freight charges be larger on the canal and river than on the lakes, giving us a saving of (2.8 the average for the two years under consideration against 4.55) $1\frac{75}{100}$ cents per bushel.

Answering an inquiry, the Hon. J. R. Dodge, Statistician to the Department of Agriculture, kindly sent the following estimate of grain affected by cheapening canal transportation:

DEPARTMENT OF AGRICULTURE,
WASHINGTON, D. C., January 26th, 1885.

SIR,—The conclusion of our work of revision of estimates enables me to give the amount of grain affected abstractly by the cheapening of canal freights from Buffalo west to the Missouri; the product is thus given:

| STATES. | BUSHELS. | STATES. | BUSHELS. |
|---|---|---|---|
| West Virginia | 3 318 000 | Iowa | 31 270 000 |
| Kentucky | 13 425 000 | Missouri | 27 500 000 |
| Ohio | 41 186 000 | Kansas | 34 990 000 |
| Michigan | 29 772 000 | Nebraska | 28 325 000 |
| Indiana | 33 745 000 | Dakota | 22 330 000 |
| Illinois | 32 374 000 | | |
| Wisconsin | 20 083 000 | Total | 359 625 000 |
| Minnesota | 41 307 000 | | |

On the amount as above given by Mr. Dodge one per cent. per bushel would give $3½ millions for distribution between the farmers and consumers.

The price of wheat in England, which to a great extent governs the price of all the wheat raised, is, at the present time, lower than ever before: lately, 30s. 6d. per quarter, or 91½ cents per bushel.

Tables Nos. 5 and 6 show the production and consumption in, and exportation from this country, of corn and wheat for the last 18 years, and Table No. 7 shows the production, importation, price, &c., for 19

## TABLE No. 5.

WHEAT.—Production, imports, exports of United States. Flour included in imports and exports. Per statement of the Bureau of Statistics, Hon. Joseph Nimmo, Jr., Chief, for the fiscal year ended June 30, 1866–7, to 1883–4, both inclusive:

| Year Ending June 30. | Production. Bushels. | Imports. Bushels. | Total Production and Imports. Bushels. | Domestic Wheat Exported. Bushels. | Domestic Flour Exported. Bushels. | Wheat and Flour Exports, Domestic and Foreign. Bushels. | Retained for Home Consumption. Bushels. | Consumption per capita. Bushels. | Per cent. exported Bushels. |
|---|---|---|---|---|---|---|---|---|---|
| 1866–7..... | 151 999 906 | 3 092 500 | 155 092 406 | 6 146 411 | 1 300 106 | 13 920 221 | 141 172 185 | 3.89 | 8.98 |
| 1867–8..... | 212 441 400 | 2 014 328 | 214 455 728 | 15 940 899 | 2 076 423 | 26 564 607 | 187 891 121 | 5.08 | 12.39 |
| 1868–9..... | 224 036 600 | 1 830 393 | 225 866 993 | 17 557 836 | 2 431 873 | 30 143 987 | 195 723 006 | 5.18 | 13.35 |
| 1869–70..... | 260 146 900 | 1 285 976 | 261 432 876 | 36 584 115 | 3 463 333 | 54 411 735 | 207 021 141 | 5.36 | 20.81 |
| 1870–71..... | 235 884 700 | 867 489 | 236 752 189 | 34 310 906 | 3 653 841 | 53 068 920 | 183 683 268 | 4.64 | 22.42 |
| 1871–72..... | 230 722 400 | 2 410 738 | 233 133 138 | 26 423 080 | 2 514 535 | 39 997 265 | 193 135 873 | 4.75 | 17.16 |
| 1872–73..... | 249 997 100 | 1 841 049 | 251 838 149 | 39 204 285 | 2 562 086 | 52 545 731 | 199 292 418 | 4.78 | 20.86 |
| 1873–74..... | 281 254 700 | 2 116 777 | 283 371 477 | 71 039 928 | 4 094 094 | 92 534 779 | 190 836 698 | 4.45 | 32.65 |
| 1874–75..... | 309 102 700 | 367 987 | 309 470 687 | 53 047 177 | 3 973 128 | 73 212 614 | 236 259 073 | 5.37 | 23.66 |
| 1875–76..... | 292 136 000 | 1 664 138 | 293 800 138 | 55 073 122 | 3 935 512 | 76 171 343 | 217 628 495 | 4.82 | 25.93 |
| 1876–77..... | 289 356 500 | 366 061 | 289 722 561 | 40 325 611 | 3 343 665 | 57 513 589 | 232 208 972 | 5.01 | 19.85 |
| 1877–78..... | 364 194 146 | 1 390 713 | 365 584 858 | 72 404 961 | 3 947 333 | 93 419 031 | 272 165 828 | 5.71 | 25.55 |
| 1878–79..... | 420 122 400 | 2 068 018 | 422 190 418 | 122 353 936 | 5 629 714 | 149 508 553 | 272 681 865 | 5.58 | 35.41 |
| 1879–80..... | 448 755 630 | 486 106 | 449 242 736 | 153 252 785 | 6 011 419 | 180 934 478 | 268 308 258 | 5.34 | 40.28 |
| 1880–81..... | 498 549 868 | 211 402 | 498 761 270 | 150 565 477 | 7 945 786 | 186 475 251 | 312 286 019 | 6.06 | 37.39 |
| 1881–82..... | 380 280 090 | 865 467 | 381 145 557 | 95 271 802 | 5 915 686 | 122 597 997 | 258 547 560 | 4.89 | 32.17 |
| 1882–83..... | 504 185 470 | 1 075 725 | 505 261 195 | 106 385 828 | 9 205 664 | 148 785 696 | 356 475 499 | 6.57 | 29.44 |
| 1883–84..... | 420 154 500 | 24 329 | 420 178 829 | 70 349 012 | 9 152 260 | 111 534 182 | 308 644 647 | 5.50 | 26.54 |

In the compilations of aggregate exports of wheat and flour, a barrel of flour is reckoned as 4½ bushels of wheat, since July 1, 1879, and as 5 bushels previous to that date.

## TABLE No. 6.

MAIZE OR INDIAN CORN.—The annual crops, exports, domestic consumption, average consumption per capita, and per centage of corn crops exported, for eighteen years, as per reports of the Washington Bureau of Statistics, Hon. Jos. Nimmo, Jr., Chief of Bureau:

| Year ending June 30. | Production, Bushels. | Imports, Bushels. | Total Production and Imports. Bushels. | Domestic Indian Corn Exports. Bushels. | Domestic Indian Corn Meal Exported. Barrels. | Exports, Domestic and Foreign. Bushels. | Retained for Home Consumption. Bushels. | * Consumption per Capita. Bushels. | Per Centage Exported. |
|---|---|---|---|---|---|---|---|---|---|
| 1866–67..... | 867 946 295 | 34 970 | 867 981 265 | 14 880 823 | 284 281 | 16 036 263 | 851 945 002 | 23.53 | 1.85 |
| 1867–68..... | 768 320 000 | 50 270 | 768 370 270 | 11 147 490 | 336 508 | 12 495 786 | 755 874 484 | 20.44 | 1.63 |
| 1868–69..... | 906 527 000 | 90 833 | 906 617 833 | 7 047 197 | 309 867 | 8 288 685 | 898 329 148 | 23.78 | .91 |
| 1869–70..... | 874 320 000 | 89 528 | 874 409 528 | 1 392 115 | 187 093 | 2 140 487 | 872 269 041 | 22.62 | .24 |
| 1870–71..... | 1 094 255 000 | 111 344 | 1 094 366 344 | 9 826 309 | 211 811 | 10 673 553 | 1 083 692 781 | 27.39 | .98 |
| 1871–72..... | 991 898 000 | 58 568 | 991 956 568 | 34 491 650 | 308 840 | 35 727 010 | 956 229 558 | 23.56 | 3.60 |
| 1872–73..... | 1 092 719 000 | 61 536 | 1 092 780 536 | 38 541 930 | 403 111 | 40 154 374 | 1 052 626 162 | 25.26 | 3.67 |
| 1873–74..... | 932 274 000 | 76 003 | 932 350 003 | 34 434 606 | 387 807 | 35 985 834 | 896 364 169 | 20.95 | 3.86 |
| 1874–75..... | 850 148 500 | 38 008 | 850 186 598 | 28 858 420 | 291 654 | 30 025 036 | 820 161 562 | 18.66 | 3.53 |
| 1875–76..... | 1 321 069 000 | 51 796 | 1 321 120 796 | 49 493 592 | 354 249 | 50 910 532 | 1 270 210 264 | 28.14 | 3.85 |
| 1876–77..... | 1 283 827 000 | 30 902 | 1 283 857 902 | 70 860 983 | 447 907 | 72 652 611 | 1 211 205 291 | 26.13 | 5.66 |
| 1877–78..... | 1 342 558 000 | 13 423 | 1 342 571 423 | 85 461 098 | 432 753 | 87 192 110 | 1 255 369 313 | 26.38 | 6.49 |
| 1878–79..... | 1 388 218 750 | 33 869 | 1 388 252 619 | 86 296 252 | 397 160 | 87 884 892 | 1 300 367 727 | 26.61 | 6.33 |
| 1879–80..... | 1 547 901 790 | 58 876 | 1 547 960 666 | 98 169 877 | 350 613 | 99 572 329 | 1 448 388 337 | 28.88 | 6.43 |
| 1880–81..... | 1 717 434 543 | 75 155 | 1 717 509 698 | 91 908 175 | 434 993 | 93 648 147 | 1 623 861 551 | 31.55 | 5.45 |
| 1881–82..... | 1 194 916 000 | 69 621 | 1 194 985 621 | 43 184 915 | 288 942 | 44 340 683 | 1 150 644 938 | 21.79 | 3.71 |
| 1882–83..... | 1 617 025 100 | 25 989 | 1 617 051 089 | 40 586 825 | 267 207 | 41 655 653 | 1 575 395 436 | 29.04 | 2.57 |
| 1883–84..... | 1 551 066 835 | 4 894 | 1 551 071 729 | 27 648 139 | 818 644 | 30 912 713 | 1 520 159 016 | 27.14 | 1.99 |

A barrel of Meal is computed as equivalent to four bushels of Corn, in the aggregate of exports.

* The consumption per capita is computed on each crop without reference to variations in reserves.

## TABLE No. 7.

Showing acreage, yield, net imports available for consumption, and average price of English wheat in the United Kingdom, 1866 to 1884, inclusive. Compiled from the "New York Produce Exchange Weekly." To which is added the wheat exported to England:

| | Acres. | Bushels—Yield. | Net Imports. | Available for Consumption. | Exported from U. S. to England. | Average Price of English Wheat. |
|---|---|---|---|---|---|---|
| 1866..... | 3 661 000 | 91 200 000 | 60 800 000 | 152 000 000 | ..... | $1 51 per bushel. |
| 1867..... | 3 640 000 | 83 120 000 | 72 080 000 | 155 200 000 | ..... | 1 98 |
| 1868..... | 3 951 000 | 126 320 000 | 63 040 000 | 189 360 000 | ..... | 1 94 |
| 1869..... | 3 932 000 | 99 920 000 | 76 640 000 | 176 560 000 | ..... | 1 46 |
| 1870..... | 3 778 000 | 112 800 000 | 63 600 000 | 176 400 000 | ..... | 1 42 |
| 1871..... | 3 831 000 | 95 760 000 | 74 560 000 | 170 320 000 | ..... | 1 71 |
| 1872..... | 3 840 000 | 80 880 000 | 93 760 000 | 174 640 000 | 19 689 600 | 1 72 |
| 1873..... | 3 670 000 | 84 400 000 | 89 840 000 | 174 240 000 | 40 517 800 | 1 77 |
| 1874..... | 3 833 000 | 109 600 000 | 93 120 000 | 202 720 000 | 51 954 700 | 1 68 |
| 1875..... | 3 514 000 | 72 992 000 | 111 520 000 | 184 512 000 | 50 518 600 | 1 37 |
| 1876..... | 3 124 000 | 77 320 000 | 97 248 000 | 174 568 000 | 42 205 600 | 1 40 |
| 1877..... | 3 321 000 | 75 456 000 | 116 024 000 | 191 480 000 | 44 597 400 | 1 72 |
| 1878..... | 3 382 000 | 94 600 000 | 115 336 000 | 209 936 000 | 67 125 600 | 1 41 |
| 1879..... | 3 056 000 | 47 920 000 | 131 200 000 | 179 120 000 | 79 507 200 | 1 33 |
| 1880..... | 3 070 000 | 72 912 000 | 129 080 000 | 201 992 000 | 84 418 300 | 1 34 |
| 1881..... | 2 957 000 | 72 992 000 | 137 600 000 | 210 592 000 | 86 688 000 | 1 37 |
| 1882..... | 3 164 000 | 81 944 000 | 159 624 000 | 241 568 000 | 87 134 700 | 1 36 |
| 1883..... | 2 715 000 | 64 992 000 | 126 528 000 | 191 520 000 | 59 088 600 | 1 28 |
| 1884..... | 2 751 000 | 76 032 000 | 131 968 000 | 208 000 000 | 54 898 700 | 1 12 |

years in England. By the kindness of Mr. Dodge, Table No. 8 is added, showing the production of the world, 2 303 200 000 bushels.

Comparing, in Table No. 7 the 3 years ending 1868 with the 3 years ending 1884, we find that in the latter period the average acreage is 84.4 per cent., the yield, 73.1 per cent.; the importations, 216.3 per cent., and the price, 73.7 per cent. of that in the first named period.

Including and since 1872 about 50 per cent. of the English importations have been from this country, 55 per cent. of our wheat and flour going to the United Kingdoms, they having received 21% of their imports from us in 1872, 65.4% in 1880, which has fallen to 41.6% in the year ending June 30, 1884, though our maximum export to England, 87 134 700 bushels, was in 1882.

## TABLE No. 8.

### Wheat Product of the World, as Estimated by Dr. Neumann Spallert.

| European Countries. | Years. | Wheat & Spelt. | | Other Countries. | Years. | Wheat & Spelt. | |
|---|---|---|---|---|---|---|---|
| | | Million Hectolitres. | Million Bushels. | | | Million Hectolitres. | Million Bushels. |
| Prussia | 1881 | 93.4 | 208.3 | United States of America | 1882 | 177.3 | 330.9 |
| German Empire | 1881 | 32.8 | 93.1 | British East India | 1881 | 108. | 306.5 |
| France | 1882 | 122.2 | 346.8 | Canada | 1881 | 10.7 | 30.4 |
| Austria-Hungary | 1881 | 43.0 | 122.0 | Australia | 1880-81 | 10.8 | 30.6 |
| Great Britain and Ireland | 1882 | 30.4 | 86.3 | Egypt | 1879 | 7.5 | 21.3 |
| Italy | 1876 | 50.9 | 114.4 | Chili | 1881 | 4.6 | 13.1 |
| Spain | | 61.1 | 173.4 | Algiers | 1879 | 7.2 | 18.4 |
| Lower Danubian Countries | 1880 | 31.2 | 88.5 | Japan | 1874 | 4. | 11.4 |
| Denmark | 1881 | 1.1 | 3.1 | Total | | 811.6 | 2303.2 |
| Sweden | 1882 | 1.3 | 3.7 | | | | |
| Belgium | 1881 | 7.6 | 21.6 | | | | |
| Netherlands | 1880 | 2.1 | 6.0 | | | | |
| Finland | 1881 | | | | | | |
| Portugal | 1877 | 2.7 | 7.7 | | | | |
| Norway | 1875 | .1 | .3 | | | | |
| Greece | 1875 | 1.6 | 4.5 | | | | |

The future rate or amount of increased production of wheat in our own country is a matter of conjecture. Taking the four decades ending 1881 to 1884, the average increase has been over 20 000 000 bushels per annum, and it seems probable that the opening of our Northwest will proceed for a few years, at least, with equal rapidity. The development of this section is partly shown in tables Nos. 9 and 10, kindly furnished by T. F. Oakes, Vice-President and General Manager of the Northern Pacific R. R.

TABLE No. 9.

Statement showing shipments of Wheat from the line of the Northern Pacific R. R. to Minneapolis and Duluth for a series of years.

| Year | To Minneapolis. Bushels. | To Duluth. Bushels. | Total. Bushels. |
|---|---|---|---|
| 1875..... | | 176 828 | 176 828 |
| 1876..... | | 196 679 | 196 679 |
| 1877..... | 8 000 | 546 619 | 554 619 |
| 1878..... | 72 000 | 1 143 871 | 1 215 871 |
| 1879..... | 377 500 | 1 883 107 | 2 260 607 |
| 1880..... | 574 000 | 2 707 236 | 3 281 236 |
| 1881..... | 1 152 500 | 2 953 308 | 4 105 808 |
| 1882..... | 1 235 500 | 3 093 762 | 4 329 262 |
| 1883..... | 1 639 975 | 4 715 438 | 6 355 413 |
| 1884..... | 904 938 | 6 043 339 | 6 948 277 |
| | 5 964 413 | 23 460 187 | 29 424 600 |

Note.—During this time, 1 350 miles of railroad have been built by other companies in country tributary to the Northern Pacific in Minnesota and Dakota.

TABLE No. 10.

Statement of sales of land made by Land Department Northern Pacific R. R. during 1884, in the State and territories named below (sales in latter part of December, '84, estimated):

| | | | |
|---|---|---|---|
| Minnesota..... | 10 188.65 | acres for..... | $45 287.03 |
| Dakota..... | 173 348.60 | " " ..... | 981 804.71 |
| Montana..... | 56 016.47 | " " ..... | 205 554.47 |
| | 239 553.72 | " " | $1 232 646.21 |

There is less general knowledge of the country opened by the Canadian Pacific. It is asserted by official authority that wheat can be grown nearly up to the 60th parallel, and a writer in *Engineering* for July 25, 1884, says: "Supposing only one-fifth of the 375 000 000 acres of wheat land said to be available in the Canadian Northwest be brought into cultivation; that the average yield is only 21 bushels per acre, and 6 of these are retained for seed and local consumption, it still leaves 1 000 000 000 bushels for exportation." This past year the country is said to have 6 000 000 bushels for exportation, and it is claimed that a yearly increase of 50 per cent. is a moderate estimate for the future, which, by 1891, would give them 100 000 000 bushels for export.

A writer in the "London Miller" says that India can produce 960 000 000 bushels of wheat per annum. The importations of Indian wheat into the United Kingdom for the 15 years ending 1881 have averaged about 8 500 000 bushels. But for the year ending March 31st, 1882, 37 000,000 bushels; for '83, 26 400 000, and for '84, about 43 000-000 bushels were received. England, convinced by long experience and intelligent observation of the advantage of expending public money to develop her resources, is both building and subsidizing railroads in India, and will probably soon be doing the same thing in Egypt.

These notes on the future production of wheat are of great interest to transportation lines, the public generally, and to our farmers in particular; for by Davenant's, Whewell's, Jevons's and others, deductions from "Gregory King's celebrated estimate of the variation in the price of corn," it appears that the price varies inversely with the square of the supply. Applying this rule to the estimated yield of the world, 2 303 200 000 bushels, we find that an additional supply of 100 000 000

bushels would reduce the price of $1 wheat to 91.86 cents, and the price of 85 cent wheat to 79.81 cents.

King's estimate was made at a time when England neither exported nor imported wheat to any extent, and such substitutes for wheat as potatoes were unknown; any reasoning from the formula given above should recognize the use of potatoes, etc., in times of financial or other strictures, also the effects of increase in population and prosperity. But after making all these allowances, it can hardly be doubted that the price of wheat will suffer a further decline that will seriously diminish the purchasing power of our farmers, who constitute about 44 per cent. of those who work at gainful occupations in our country.

A fall of 5 cents per bushel in the price of wheat would reduce their income by from $20 000 000 to $25 000 000, which would be taken mainly from articles that go to make life better worth living, the freight on which pays the highest price to transporters.

The increasing production of wheat can only be stopped by rendering it unprofitable, and since countries dependent on wheat grown for export have always been among the poorest, an immense amount of misery will be endured before that point is reached.

There seem only these methods of alleviating the probable distress of our farmers, and of those who directly or remotely serve them, viz.: either increasing the relative number of consumers, or finding new markets for our agricultural products, or increasing the efficiency of labor and machinery used in making the crop, or decreasing the cost of distribution. If Mr. Sweet's proposed enlargement of our canal will accomplish the last it should have the vigorous and immediate support of both the State and National Governments.

The report of the House Military Committee for 1862 exhibits to us another necessity for enlarging the canal as follows:

"The United States and Great Britain are equally prohibited by treaty stipulations from building or keeping afloat a fleet of war vessels upon the lakes. At the same time, on the shores of these lakes the United States have many wealthy towns and cities, and upon their waters an immense commerce; these are unprotected by any defenses worthy of special notice, but are as open to incursion as Mexico when invaded by Cortez.

"A small fleet of light-draft, heavily armed, iron-clad gunboats could, in one month, in despite of any opposition that could be made by

extemporized batteries, pass up the St. Lawrence into the lakes and shell every city and village from Ogdensburg to Chicago. At one blow it could sweep our commerce from that entire chain of waters. To be able to strike a blow so effective, Great Britain constructed a canal around the Falls of Niagara. By this single work the entire chain of lakes was opened to all British light-draft ocean vessels.

"Perceiving our ability to erect works upon the St. Lawrence that might command its channel, and thus neutralize all they had done, Great Britain dug a canal from the foot of Lake Ontario, on a line parallel to the river, but beyond the reach of American guns, to a point on the St. Lawrence below, beyond American jurisdiction, thus securing a channel to and from the lakes out of our reach.

"Occupied by our own vast commercial enterprises and by violent party conflicts, our people failed to notice at the time that the safety of our entire Northern frontier had been destroyed by the digging of two short canals. Near the head of the St. Lawrence the British, to complete their supremacy on the lakes, have built a large naval depot for the construction and repair of vessels, and a very strong fort to protect the depot and the outlet of the lake—a fort which cannot be reduced, it is supposed by them, except by regular approaches.

"The result of all this is that, in the absence of ships-of-war on the lakes and of means to convey them there from the ocean, the United States, upon the breaking out of a war, would, without navy yards and suitable docks, have to commence the building of a fleet upon Lake Ontario and another upon the Upper Lakes."

The writer knows that such citations will encounter the adverse force of English opinion, that so readily and ably comes to the front in all instances where the interests of the two countries are likely to conflict. But England, that has seven armored vessels carrying 22 seven-inch rifled cannon, and over 100 unarmored ones carrying 106 seven-inch rifles, and some 300 sixty-four-pounders and machine guns, all of which will pass through the locks of the enlarged Welland Canal, is the only power that can more than skirmish on our seaboard.

Our war of 1812, costing $100 000 000, and 30 000 lives, when our population was about 8 000 000, was forced on us greatly in consequence of our lack of preparation for it, and there is no mode by which a nation can so certainly prevent those aggressions that lead to war as being thoroughly prepared for war. It is said that Chancellor Livingston,

as one of the Governor's Council, cast the deciding vote for the construction of the Erie Canal, more as preventive of another war with Great Britain than as a commercial enterprise.

The cost to this Government of the Union and Central Pacific Railroads, completed in 1869, was a loan of $54 000 000, which will probably be repaid. The cost of one summer's campaign on the Plains against the Indians, during the construction of these roads, was said to have been $55 000 000, and no one can look for the return of that money. Now, there are five lines of railroads to the Pacific, and Indian campaigns are of the past.

The resources of our country available for constructing the enlarged canal are much more abundant than when a four-foot navigation was determined on in 1817.

Table No. 11 shows the population of the United States in the years 1810, 1820, 1830 and 1880; also the population of the States directly served by the canal in the above mentioned years.

TABLE No. 11.

| | 1810. | 1820. | 1830. | 1880. |
|---|---|---|---|---|
| Total population of U. S.... | 7 239 881 | 9 633 822 | 12 866 020 | 50 155 783 |
| Population of States and Territories west of Pennsylvania and north of the Ohio, including Missouri, Kansas and Dakota..... | 293 169 | 11 249 921 858 957 | 1 610 473 | 17 364 111 |
| Population of New York and New Jersey..... | 1 204 601 | 1 649 537 | 2 239 431 | 6 213 987 |
| Population of New England States ..... | 1 471 973 | 1 659 579 | 1 954 717 | 4 010 529 |
| Total for States above..... | 2 969 743 | 4 168 073 | 5 804 621 | 27 588 627 |
| | | 4 986 347 | | |

If we assume the increase of population to have been uniform between 1820 and 1830, it will be seen that while the whole country has increased since the completion of the canal at the rate of 438 per cent., the country immediately served by it has increased at the rate of 553.3 per cent.

The increase in our resources in the last 30 years is partly shown by the following, taken from a pamphlet on "The Relations of the Railroads to Commerce," by the Hon. Joseph Nimmo, Jr., Chief of Bureau of Statistics:

Material Resources of the United States in 1850 and in 1880:

| | 1850. | 1880. | Per cent. of Increase. |
|---|---|---|---|
| Population | 23 191 876 | 50 155 783 | 216 |
| Improved land in farms, acres | 113 032 614 | *284 771 042 | 252 |
| Wheat produced, bushels | 100 485 944 | 420 154 500 | 418 |
| Corn, " " | 592 071 104 | 1 551 066 895 | 262 |
| Pig iron produced, tons | 563 755 | 5 146 972 | 913 |
| Coal " " | 7 358 899 | 96 000 000 | 1 304 |
| Railroads in operation, miles. | 9 021 | 121 592 | 1 348 |
| Value of products of manufacture | $1 019 106 616 | *$5 369 579 191 | 526 |

* For the census year 1880.

The foreign commerce of New York has increased as follows:

| | Exports. | Imports. |
|---|---|---|
| 1817 | $18 707 433 | |
| 1825 | 35 259 261 | $49 636 174 |
| 1883 | 384 613 204 | 486 355 355 |

The assessed valuation was :

| | State of New York. | County of New York. |
|---|---|---|
| 1817 | $299 418 207 | $78 895 735 |
| 1825 | 312 393 655 | 101 160 046 |
| 1883 | 3 014 591 372 | 1 079 130 669 |

The number, capital, deposits, &c., of banks in 1830 and 1882, the extreme years attainable, was as follows :

| | Number. | Capital. | Deposits. | Circulation. | Loans and Discounts. |
|---|---|---|---|---|---|
| 1830 | 330 | $145 000 000 | $55 000 000 | $61 000 000 | $200 000 000 |
| 1882, Nat'l banks | 2664 | 524 000 000 | 992 000 000 | 289 000 000 | 1 245 000 000 |
| " State " | 1061 | 123 000 000 | 490 000 000 | ... ..... . | Not obtained. |
| Total for 1882 | 3725 | $647 000 000 | $1 482 000 000 | $289 000 000 | |

Few can doubt that either the State or General Government could easily procure the money necessary for the proposed improvement of the Erie canal at 3 or 3½ per cent.

The ease with which money can be raised to prosecute large public works when the project commands confidence, is shown by the expenditure of $54 419 000 on additions to construction by the New York Central and Hudson River Railroad in the past 11 years, understood to have been greatly used in constructing the 3d and 4th tracks; the completion of a double-track road to Buffalo, by the Delaware, Lackawanna and Western Railroad ; the second tracking of the Erie Railway ; the expenditures of the Lehigh Valley Railroad at and about Buffalo; the completion of roads to Emporium and Pittsburgh, and the partial completion of the West Shore Railroad. The increase in the stock and bonded indebtedness of the roads mentioned above during the 11 years has been:

| | |
|---|---|
| N. Y. C. and H. R. R. R. | $22 261 700 |
| Erie | 33 384 382 |
| Pennsylvania | 41 075 653 |
| Lehigh Valley | 18 359 604 |
| Delaware, Lackawanna and Western | 30 997 003 |
| N. Y., West Shore and Buffalo | 78 491 400 |
| | $224 569 742 |

Most of these expenditures were made to compete with canal and river freights, which, on wheat, have averaged for the past 11 years $2 13½ per ton from Buffalo to New York, or $4\frac{3}{10}$ mills per ton-mile, showing the soundness of Dean Richmond's views when, as President of the New York Central, he used his influence to free the canal from tolls and increase its prism, so that it should be more efficient in carrying grain and heavy freight, saying that men travel over the same general routes that freight follows, and by increasing the efficiency of the water routes for raw and bulky produce, the railroads parallel to that route would have increased traffic from passengers and manufactured articles.

Ex-governor Seymour, whose opinions derive weight from his long and intimate connection with the canals of this State, maintains that the phenomenal prosperity of our country during the past 20 years is due to the cheapening of transportation rates by the lake and canal route; and Edward Atkinson, in his tract "The Railway, The Farmer and The Public," says: "Had the actual quantity of merchandise moved by railroad in the year 1880 been subjected to the average rate per ton per mile which was charged for 1866 to 1869 inclusive, the difference would have amounted to at least $500 000 000 and perhaps $800 000 000 more than the actual charge of 1880," and he marshals many figures which show the interdependence between the increase of grain crops and miles of railroads on the one hand, and the decrease of freight rates on the other. If the conclusions of these gentlemen are correct, the proposed improvement in the Erie Canal may more than repay the country its cost in one year.

By Table No. 12, it will be noticed that for the past 6 or 7 years railroad freights east of Chicago have been about stationary, near 8 mills per ton-mile, and at that rate the railroads have kept the canal freights from increasing, and Table No. 13 shows that they have carried a generally increasing percentage of grain from Chicago to the seaboard.

| Year. | Grain Crops of the United States. | Value of Exports of Bread and Breadstuffs from the United States. | Excess of Exports over Imports. | Excess of Imports over Exports. | Railroads in the United States. | | RAIL |
|---|---|---|---|---|---|---|---|
| | Corn, Wheat, Rye, Oats, Barley and Buckwheat. | | *Merchandise.* | | Miles Built. | Miles in Operation January 1st. | Ton c the Rep the Ne |
| 1865 | 1 127 499 187 | $53 941 231 | ..... | 72 716 277 | 1 177 | 33 908 | ..... |
| 1866 | 1 343 027 858 | 41 249 054 | ..... | 85 952 544 | 1 716 | 35 085 | ..... |
| 1867 | 1 329 729 400 | 41 288 804 | ..... | 101 254 955 | 2 449 | 36 801 | ..... |
| 1868 | 1 450 789 000 | 69 024 059 | ..... | 75 483 541 | 2 979 | 39 250 | ..... |
| 1869 | 1 491 412 100 | 53 724 154 | ..... | 131 388 682 | 4 615 | 42 229 | ..... |
| 1870 | 1 629 027 600 | 72 250 933 | ..... | 43 186 640 | 6 070 | 46 844 | 2 |
| 1871 | 1 528 776 100 | 79 381 187 | ..... | 77 403 506 | 7 379 | 52 914 | 2 |
| 1872 | 1 664 331 600 | 84 586 273 | ..... | 182 417 491 | 5 878 | 60 293 | 2 |
| 1873 | 1 538 892 891 | 98 743 151 | ..... | 119 656 288 | 4 107 | 66 171 | 3 |
| 1874 | 1 455 180 200 | 161 198 864 | 18 876 698 | ..... | 2 105 | 70 278 | 3 |
| 1875 | 2 032 235 300 | 111 458 265 | ..... | 19 562 725 | 1 713 | 72 383 | 3 |
| 1876 | 1 962 821 600 | 131 181 555 | 79 643 481 | ..... | 2 712 | 74 096 | 3 |
| 1877 | 2 178 934 646 | 117 806 476 | 151 152 094 | ..... | 2 281 | 76 808 | 3 |
| 1878 | 2 302 254 950 | 181 777 841 | 257 814 234 | ..... | 2 687 | 79 089 | 3 |
| 1879 | 2 434 884 541 | 210 355 528 | 264 661 666 | ..... | 4 721 | 81 776 | 4 |
| 1880 | 2 448 079 181 | 288 036 835 | 167 683 912 | ..... | 7 048 | 86 497 | 5 |
| 1881 | 2 066 029 570 | 270 332 519 | 259 712 718 | ..... | 9 789 | 93 545 | 6 |
| 1882 | 2 699 394 496 | 182 670 528 | 25 902 683 | ..... | 11 591 | 103 334 | 7 |
| 1883 | 2 623 319 089 | 208 040 850 | 100 658 488 | ..... | 6 618 | 114 925 | 7 |
| 1884 | ..... | 162 544 715 | 72 815 916 | ..... | 3 990 approximate. | 121 543 | |

# TABLE No. 12.

| RAILROADS REPORTING TO THE STATE OF NEW YORK. | | | | | | | | | | | | RAI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | NEW YORK CENTRAL & HUDSON RIVER RAILROAD. | | | | | | DISTRIBUTION OF FREIGHT BY PERCENTA | | | | |
| | | *Ton Mileage.* | | | | | | | | | | |
| Tons Moved on all the Railroads Reporting to the State of New York. | Rate Received per ton Mile. *Cents.* | Amount. | Rate Received. *Cents.* | Percentage of Operating Expenses to Gross Earnings. | Total Tons Moved. | Percentage of Local. | Coal, Stone, Ores, Iron and Manufactured Articles. | Forest Products. | Grain, Live Stock and Animal Products. | Petro um, chan and Misce neou |
| | | 318 732 070 | 3.451 | 79.98 | | | | | | |
| | | 388 620 986 | 3.092 | 77.62 | | | | | | |
| | | 435 417 629 | 2.754 | 77.54 | | | | | | |
| | | 455 046 715 | 2.742 | 68.00 | | | | | | |
| | | 589 362 849 | 2.387 | 64.18 | 14 559 704 | 54.88 | | | | |
| 20 572 212 | 1.7016 | 769 087 777 | 1.853 | 62.91 | 14 864 598 | 52.79 | | | | |
| 22 739 447 | 1.7005 | 888 327 865 | 1.649 | 61.95 | 15 464 340 | 57.38 | | | | |
| 27 427 415 | 1.6645 | 1 020 908 885 | 1.592 | 64.29 | 20 983 068 | 57.48 | | | | |
| 34 358 119 | 1.6000 | 1 246 650 063 | 1.573 | 63.22 | 26 589 562 | 72.94 | | | | |
| 33 555 595 | 1.4480 | 1 391 560 707 | 1.462 | 62.34 | 26 199 435 | 69.10 | 40.20 | 9.08 | 31.61 | 18.9 |
| 32 408 547 | 1.3039 | 1 404 008 029 | 1.275 | 64.93 | 25 750 501 | 60.19 | 40.50 | 8.75 | 30.22 | 20.5 |
| 34 163 958 | 1.1604 | 1 674 447 055 | 1.051 | 62.48 | 29 348 799 | 49.91 | 41.93 | 7.50 | 30.21 | 20.3 |
| 34 984 781 | 1.0590 | 1 619 948 685 | 1.014 | 61.16 | 30 338 004 | 55.23 | 41.20 | 7.49 | 30.45 | 20.8 |
| 38 320 573 | .9994 | 2 042 755 132 | .930 | 61.11 | 31 909 172 | 50.30 | 40.10 | 8.06 | 32.78 | 15.1 |
| 47 350 174 | .8082 | 2 295 827 387 | .796 | 59.26 | 33 487 248 | 51.52 | 38.23 | 7.25 | 38.20 | 12.7 |
| 57 356 128 | .9220 | 2 525 139 145 | .879 | 59.04 | 48 511 176 | 53.18 | 43.88 | 7.82 | 34.13 | 13.9 |
| 66 584 375 | .8390 | 2 646 804 098 | .783 | 66.38 | 55 279 369 | 53.42 | 46.54 | 8.79 | 31.32 | 13.6 |
| 71 171 516 | .8170 | 2 394 799 310 | .738 | 71.08 | 61 226 315 | 64.47 | 50.95 | 9.98 | 23.63 | 15.4 |
| 74 019 679 | .8990 | 2 200 896 780 | .910 | 68.34 | 63 683 423 | 66.53 | 50.77 | 9.32 | 25.89 | 13.0 |
| | | | | average, 66.10 | | | | | | |

| BY PERCENTAGE. | | Ton Mileage. | | PASSENGER TRAFFIC. | | | | LAKE SHORE & MICHIGAN SOUTHERN RAILROAD. | |
|---|---|---|---|---|---|---|---|---|---|
| in, ve and nal ucts. | Petroleum, Merchandise and Miscellaneous. | Amount. | Rate Received. Cents. | Number Carried. | Passenger Miles. | Rate per Mile. Cents. | Percentage of Operating Expenses to Gross Earnings. | Ton Mileage. Amount. | Ton Mileage. Rate Received. Cents. |
| .... | ..... | ..... ... | ..... | 9 436 416 | | | | | |
| .... | ..... | 1 332 317 931 | 2.446 | 10 361 078 | 470 284 462 | 3.317 | | | |
| .... | ..... ... | 1 673 017 568 | 1.993 | 11 883 657 | 555 189 996 | 3.026 | ..... | 574 035 571 | 1.504 |
| .... | ..... | 1 773 983 405 | 2.215 | 12 000 000 | 413 419 943 | 3.957 | 68.13 | 733 670 696 | 1.391 |
| .... | ..... ... | 2 923 292 084 | 1.569 | 12 068 832 | 549 515 164 | 2.935 | 68.73 | 924 844 140 | 1.374 |
| .... | ..... | 3 420 889 453 | 1.566 | 13 885 688 | 605 614 937 | 2.838 | 71.92 | 1 053 927 189 | 1.335 |
| .61 | 18.91 | 3 717 622 979 | 1.334 | 15 487 294 | 621 887 641 | 2.769 | 72.09 | 999 342 041 | 1.180 |
| .22 | 20.53 | 3 431 745 707 | 1.259 | 17 193 948 | 654 804 294 | 2.599 | 72.84 | 943 236 161 | 1.010 |
| .21 | 20.36 | 3 799 397 649 | 1.117 | 18 175 963 | 653 184 018 | 2.524 | 71.75 | 1 133 834 828 | .870 |
| .45 | 20.86 | 4 146 926 306 | .933 | 17 297 852 | 697 097 680 | 2.237 | 74.23 | 1 080 005 561 | .864 |
| .78 | 15.19 | 4 286 378 592 | .961 | 16 626 151 | 591 003 887 | 2.477 | 67.51 | 1 340 467 826 | .734 |
| .20 | 12.76 | 4 914 503 869 | .815 | 15 040 873 | 542 614 915 | 2.479 | 66.79 | 1 733 423 440 | .642 |
| .13 | 13.97 | 6 655 562 182 | .895 | 20 475 093 | 767 870 514 | 2.373 | 60.71 | 1 851 166 018 | .750 |
| .32 | 13.65 | 7 607 215 616 | .915 | 22 830 441 | 920 108 052 | 2.336 | 63.51 | 2 021 775 468 | .617 |
| .63 | 15.44 | 8 244 019 566 | .807 | 29 210 984 | 1 098 768 751 | 2.310 | 72.13 | 1 892 868 224 | .628 |
| .89 | 13.67 | 8 577 357 803 | .875 | 31 378 589 | 1 131 548 653 | 2.429 | 67.68 | 1 689 512 415 | .728 |
| | | | | | | | average, 69.08 | | |

## TABLE No. 13.

### Shipment of Flour and Grain from Chicago by Lake and Rail.

| | FLOUR—BARRELS. | | | | GRAIN—BUSHELS. | | | |
|---|---|---|---|---|---|---|---|---|
| | By Lake. | % | By Rail. | Total. | By Lake. | % | By Rail. | Total. |
| 1858... | 377 500 | 82.0 | 81 539 | 459 039 | 17 758 226 | 99.4 | 98 466 | 17 856 692 |
| 1859... | 365 300 | 54.4 | 306 523 | 671 823 | 12 214 300 | 93.1 | 905 092 | 13 119 392 |
| 1860... | 218 400 | 34.8 | 408 082 | 626 482 | 25 670 314 | 96.2 | 1 018 200 | 26 688 514 |
| 1861... | 542 700 | 35.1 | 1 001 618 | 1 544 318 | 40 849 900 | 97.0 | 1 281 200 | 42 131 100 |
| 1862... | 1 144 000 | 63.0 | 672 000 | 1 816 000 | 47 451 000 | 98.2 | 875 000 | 48 326 000 |
| 1863... | 1 006 000 | 78.8 | 270 800 | 1 276 800 | 42 279 000 | 94.2 | 2 585 500 | 44 864 500 |
| 1864... | 1 034 300 | 83.1 | 210 000 | 1 244 300 | 34 167 000 | 89.5 | 3 987 600 | 38 154 600 |
| 1865... | 646 000 | 47.4 | 717 300 | 1 363 300 | 40 537 800 | 91.9 | 3 568 300 | 44 106 100 |
| 1866... | 481 000 | 23.6 | 1 555 700 | 2 036 700 | 44 335 000 | 85.2 | 7 694 700 | 52 029 700 |
| 1867... | 650 367 | 33.9 | 1 267 558 | 1 917 925 | 40 429 047 | 89.6 | 4 697 514 | 45 126 561 |
| 1868... | 774 556 | 28.4 | 1 949 261 | 2 723 817 | 44 357 586 | 81.8 | 9 836 089 | 54 193 675 |
| 1869... | 829 272 | 35.4 | 1 509 791 | 2 339 063 | 34 256 152 | 76.0 | 10 808 048 | 45 064 200 |
| 1870... | 574 393 | 33.7 | 1 131 604 | 1 705 997 | 35 461 981 | 76.7 | 10 754 037 | 46 216 018 |
| 1871... | 488 705 | 38.0 | 798 869 | 1 287 574 | 57 563 698 | 87.2 | 8 443 008 | 66 006 706 |
| 1872... | 223 457 | 16.4 | 1 137 871 | 1 361 328 | 59 354 223 | 76.8 | 17 884 025 | 77 238 248 |
| 1873... | 428 321 | 18.6 | 1 875 169 | 2 303 490 | 57 460 921 | 70.7 | 23 770 466 | 81 231 387 |
| 1874... | 555 152 | 24.0 | 1 751 424 | 2 306 576 | 52 361 385 | 71.1 | 21 279 764 | 73 641 099 |
| 1875... | 328 283 | 14.4 | 1 956 830 | 2 285 113 | 42 691 835 | 69.0 | 19 394 330 | 62 086 165 |
| 1876... | 236 591 | 9.0 | 2 398 247 | 2 634 838 | 40 078 335 | 53.2 | 35 306 200 | 75 384 535 |
| 1877 .. | 148 779 | 6.0 | 2 333 526 | 2 482 305 | 57 054 936 | 71.7 | 22 480 768 | 79 535 704 |
| 1878... | 321 648 | 11.2 | 2 457 992 | 2 779 640 | 67 887 719 | 64.0 | 38 279 370 | 106 167 089 |
| 1879... | 330 257 | 10.6 | 2 760 283 | 3 090 540 | 62 140 003 | 55.7 | 49 480 946 | 111 620 949 |
| 1880... | 527 873 | 18.5 | 2 334 864 | 2 862 737 | 91 777 647 | 64.8 | 49 717 152 | 141 484 799 |
| 1881 .. | 159 415 | 3.6 | 4 340 328 | 4 499 743 | 56 662 224 | 47.2 | 63 396 529 | 120 058 753 |
| 1882... | 792 764 | 20.6 | 3 050 303 | 3 843 067 | 50 782 325 | 52.1 | 46 789 807 | 97 571 132 |
| 1883... | 801 099 | 20.0 | 3 198 332 | 3 999 431 | 55 599 876 | 44.9 | 68 122 942 | 123 722 820 |
| 1884... | 753 357 | 15.3 | 4 185 645 | 4 939 002 | 73 376 303 | 61.0 | 46 893 111 | 120 269 414 |

Under these circumstances they claim that no further reduction in the cost of handling freight is possible.

It will not be possible till the canal is again made a serious competitor.

Few can doubt that, in their struggle with these new conditions, the railroad managers of this country will be fully as successful as in times past.

It will be noticed that for the years 1883 and 1884, during which there were no tolls on the canal, the freight on wheat was 93¼ cents per ton on the lakes and $1 51¾ cents on the canal; if the difference, 58½ or even 50 cents per ton, could be applied to the 50 000 000 tons shown in Table No. 1, it would amount to $25 000 000, and by the time the enlargement of the canal could be completed, the freight affected by it would doubtless amount to over 100 000 000 tons; in fact, Mr. E. H.

Walker, the statistician of the New York Produce Exchange, returns a tonnage, including the Baltimore and Ohio and Grand Trunk railroads, of over 90 000 000 tons for 1883.

In addition to the direct benefit to the producers and consumers of our country accruing from a reduction in freight charges, such reduction, since freight tends to follow the cheapest, quickest and surest route, will give us a large share of the traffic of the Saskatchewan country, the freights, commissions and exchanges on which, as set forth by Goschen, will act with the same force as a commodity actually produced and exported, and will form a noticeable element in the revenue by which we will be enabled to discharge our foreign liabilities.

This traffic, while in no sense a charge on our production, distribution or consumption, presents us with collateral advantages of no small value in the way of cheaper freights on other exported commodities, a larger volume of return freights, and an increased number of immigrants, the distribution of which should as far as possible contribute to the advantage of our own transportation lines, rather than those of Canada.

The normal immigrant fare to St. Louis is $17 75; to St. Paul, $22 00; to which may be added extra baggage, $3 50; meals and small stores, $1 50—amounting to $20 75 and $27 00 respectively. If we assume $20, and apply this sum to the 80 692 immigrants that passed through Canada, in 1882, to our northwestern States, we have $1 613 840. If we apply this sum to the 788 992 immigrants that landed on our shores in this same year, we will have $15 779 840.

I am told by Mr. E. R. Livermore, of the New York Produce Exchange, that the terminal charges in this port on grain arriving by rail are as follows:

Lighterage, from railroad elevator to ship, 1¼c. per bushel; weighing, ¼c. per bushel (seller and buyer each paying half); dumping into steamer and trimming or stowing in ship's hold, 7-10c. per bushel.

On grain arriving by canal:

The elevator charges the canal boat ¼c. per bushel for unloading; this includes elevation and trimming canal boat cargo; weighing, ¼c. per bushel (seller and buyer each paying half); elevator charges for dumping into ship and stowing or trimming the same, 7-10c. per bushel.

| BY RAIL. | Cents. | BY CANAL. | Cents. |
|---|---|---|---|
| Lighterage | 1.25 | Unloading | .50 |
| Weighing | .50 | Weighing | .50 |
| Dumping and trimming | .70 | Dumping and trimming | .70 |
| By rail | 2.45 | By canal | 1.70 |

To the charges by canal must be added $12 per cargo for towing.

About half the grain that comes to this port is stored, which involves:

Unloading, ¼c.; weighing, in and out, ¼c.; storage, ¼c. for each ten days, for, say thirty days, ¾c., 1¾ cents.

In addition to which are commissions, varying from 1 cent on wheat to ½ cent on oats. Insurance, 0.4 per cent. by steam and 1.4 per cent. by sail, with exchange, &c. So that the expenditures at this port may be safely estimated at 4 cents per bushel on wheat.

The most remunerative part of a ship's cargo is boxed or barreled goods, and in general steamers carry from 2 to 3 tons of other merchandise for one ton of grain; but while grain is to some extent a by-product in transatlantic traffic, paying the smallest rate per ton, the certainty of a grain freight or of a sufficient amount to complete a cargo seems necessary to the commerce of our ports, particularly as many passenger steamers are so built that grain or other freight of equal specific gravity is indispensable as ballast to prevent overturning.

The return freight rates average about ¼ the rates to Europe; steamers loading in this port spend from $1 000 to $10 000, averaging $4 000 each, 33 steamers in general being employed to export 1 000 000 bushels.

If we assume the freight rate from either Chicago, Duluth, or Fort William at 7 cents, and add 4 cents for terminal charges, the 6 000 000 bushels of Manitoba wheat, which it is said will this year be exported by a syndicate of Canadian and other bankers, through Montreal, would have left in this country $660 000, besides which 198 steamers would have been loaded here, expending $737 000.

The grain grown in the Northwest has at present two routes to an European market, viz., by our own seaboard and by Montreal; much of it will probably soon have a third, viz., by Hudson Bay. Montreal has deepened the St. Lawrence from 13 to 25 feet, and Mr. Kennedy is now dredging for 27½ feet, with 30 feet on short bars. This chain of canals between Lakes Erie and Ontario, and down the St. Lawrence to

Montreal, will soon have 14 feet on their miter sills, giving her a decided advantage over New York in the cheapness with which grain can be handled, New York having only the advantage of a larger market with certainty of freights to offset the cheapness offered by Montreal.

Of the necessity to England of the Hudson Bay route, J. Beaufort Hurlbert, LL.D., in "Food Zones of Canada," printed in the "Canadian Gazette" and reprinted in England, apparently for distribution in that country, says: "If England should be engaged in a war with the United States, or with one of the great powers of Europe, privateers would swarm over the seas, intercepting her merchantmen.

"The contingency of war must never be forgotten in the forecast of a nation's future, and England makes all her calculations upon the assumption that she will be mistress of the seas. In a few years Canada could supply the food deficiency of the British Islands. If only a tithe of the fertile lands in Manitoba and the Territories to her west and northwest were under cultivation, they could furnish food for the 30 000 000 odd of her population. Port Nelson, on Hudson Bay, is nearer Liverpool than New York, and Port Nelson is within 300 miles of Lake Winnipeg, the centre of the fertile plains of the Northwest. Two railways have been chartered from Lake Winnipeg to the Bay, one to Port Nelson and the other to Port Churchill. * * * * * * * Both coasts would be in British territory. No shelter for privateers could be found north of the route from Hudson Bay to Liverpool; from the south alone would her corn-laden ships be exposed to danger. It would be the shortest and easiest line to defend. That route has been used for 200 years by sailing vessels in the service of the Hudson's Bay Company. Agricultural products are heavy and costly of transit, and shipments through Hudson Bay would save 2 000 miles inland navigation."

It is submitted that an examination of the accompanying tables will show that while freights on bulky and low-priced products will be materially reduced, the reduction will increase rather than diminish the revenues of the railroad, in conformity with the opinion of Dean Richmond. Also, that the increased volume of transportation has very closely followed the deepening of the harbors and channels of the lakes and the building of land grant railroads, as given below by decades:

| | Decade Ending— | | | | Total. |
|---|---|---|---|---|---|
| | 1849. | 1859. | 1869. | 1879. | |
| No. of roads commenced. | 2 | 11 | 20 | 20 | 53 |
| " miles built..... | 88 | 2 776.72 | 5 244.26 | 9 434.38 | 17 543.36 |

Attention has been mainly directed in the foregoing to the effect of the proposed improvement on the price and transportation of wheat and its resulting commerce, neglecting consideration of the influence of cheaper freights on the production of our own manufactures, which, according to Mr. Nimmo's report quoted above, were, in 1880, "five times the value of the exports of the products of manufacture from Great Britain and Ireland during the year 1883." Ignoring also the cheapened distribution on those items that do not enter into computation in the summary of the world's commerce, the weight of all bread, breadstuffs, flour and grain exported during 1880 was about 4 550 000 tons. The weight of the iron ore shipped from Michigan in 1882 was 3 302 000 tons, while the 5 178 000 tons of pig iron made in that year necessitated a total shipment of 29 272 000 tons; 97 553 000 tons of coal were mined, and our lumber crop of last year weighed 12 500 000 tons. None of these commodities are transhipped as cheaply as grain. Nor has reference been made to the probability of the construction, hand in hand with this work, or immediately succeeding it, of a steamboat canal from the Red River of the North to Duluth, and a land-locked navigation from Boston to the mouth of the Rio Grande, with at least one channel of depth equal to that adopted for the Erie Canal, connecting the lakes with the mouth of the Mississippi.

Adam Smith says, in his "Wealth of Nations:" "The great object of the political economy of every country is to increase the riches and power of that country." And by increasing the riches and power of our own country we are doing the greatest good to the greatest number, not only of our own inhabitants, but to those of the world, for here labor gives the largest product per unit of time, and receives the largest reward both in money and in nearly all the necessaries of life that money goes to buy.

He also says: "The manufactures of a rich nation may, no doubt, be very dangerous rivals to those of their neighbors." And experience seems to prove the same true in all commercial relations.

The weighty objections that may be urged against the centralization of power and influence in a great city are not ignored. But a city handling the exchanges of the world is certain to grow up on this continent where natural and artificial conveniences enables it to most cheaply, surely and quickly mediate the transactions between the old and new worlds. Doubtless, it would be better for the whole country if it occupied a more central position, but the Alleghanies prevent that, and the necessities of commerce seem to decide that it shall be on either the Hudson or St. Lawrence rivers. It will the most increase the riches and power of our country if it is on the Hudson.

Tables Nos. 14 to 18, with a diagram on plate No. I prepared from the report of the Auditor of the Canals of New York, for 1881, are appended as of interest and containing information not generally accessible.

TABLE No. 14.

Showing the cost of transportation per ton on the canals on up and down freight, the tolls paid to the State, and the carriers' charge:

| | Up Freight per Ton from Albany to Buffalo. | | | Down Freight per Ton from Buffalo to Albany. | | |
|---|---|---|---|---|---|---|
| | Average per Year. | Tolls Deducted. | Leaving Freight. | Average per Year. | Tolls Deducted. | Leaving Freight. |
| Average from 1830 to 1833, 4 years | $18 65 | $9 85 | $8 80 | $8 84 | $4 74 | $4 10 |
| Average from 1834 to 1837, 4 years. | 18 00 | 6 57 | 11 43 | 7 15 | 3 28 | 3 87 |
| Average from 1838 to 1841, 4 years. | 16 10 | 6 57 | 9 53 | 6 94 | 3 28 | 3 66 |
| Average from 1842 to 1845, 4 years. | 11 75 | 6 57 | 5 18 | 5 93 | 3 28 | 2 65 |
| Average from 1846 to 1849, 4 years. | 7 85 | 4 80 | 3 05 | 5 90 | 2 92 | 2 98 |
| Average from 1850 to 1853, 4 years. | 6 05 | 3 76 | 2 29 | 5 07 | 2 37 | 2 70 |
| Average from 1854 to 1857, 4 years. | 5 05 | 2 92 | 2 13 | 4 86 | 2 19 | 2 67 |
| Average from 1858 to 1861, 4 years | 2 45 | 1 24 | 1 21 | 3 54 | 1 51 | 2 03 |
| Average from 1862 to 1865, 4 years. | 2 52 | 1 22 | 1 30 | 4 66 | 2 11 | 2 55 |
| Average from 1866 to 1869, 4 years. | 2 60 | 1 05 | 1 55 | 4 61 | 2 11 | 2 50 |
| Average from 1870 to 1873, 4 years. | 2 60 | 1 05 | 1 55 | 3 45 | 1 05 | 2 40 |
| Average from 1874 to 1877, 4 years. | 2 60 | 1 05 | 1 55 | 2 22 | 70 | 1 52 |
| Average from 1878 to 1881, 4 years. | 2 05 | 57 | 1 48 | 1 53 | 36 | 1 17 |
| Annual average from 1830 to 1881, 52 years..... | $7 55 | $3 63 | $3 92 | $4 97 | $2 30 | $2 67 |

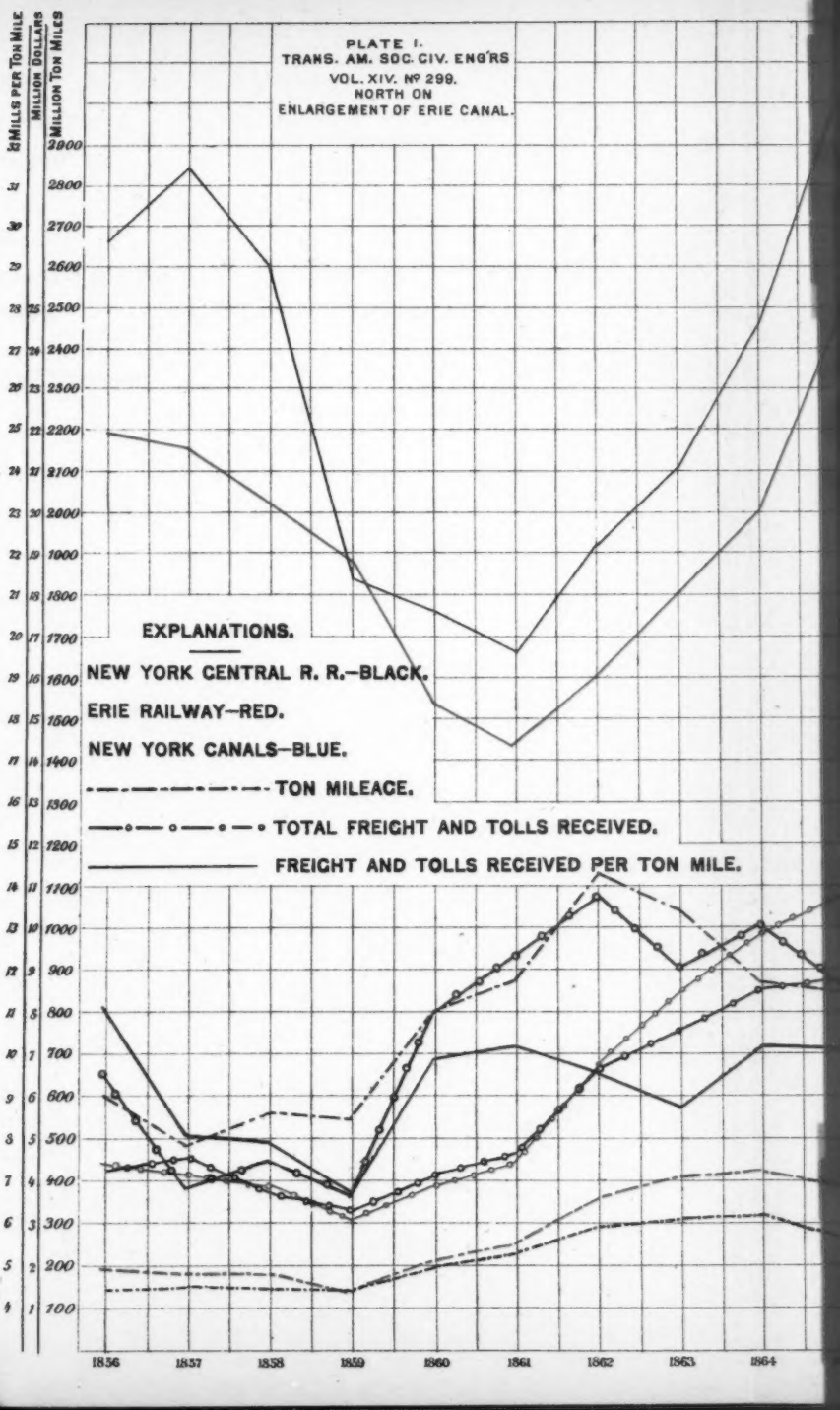
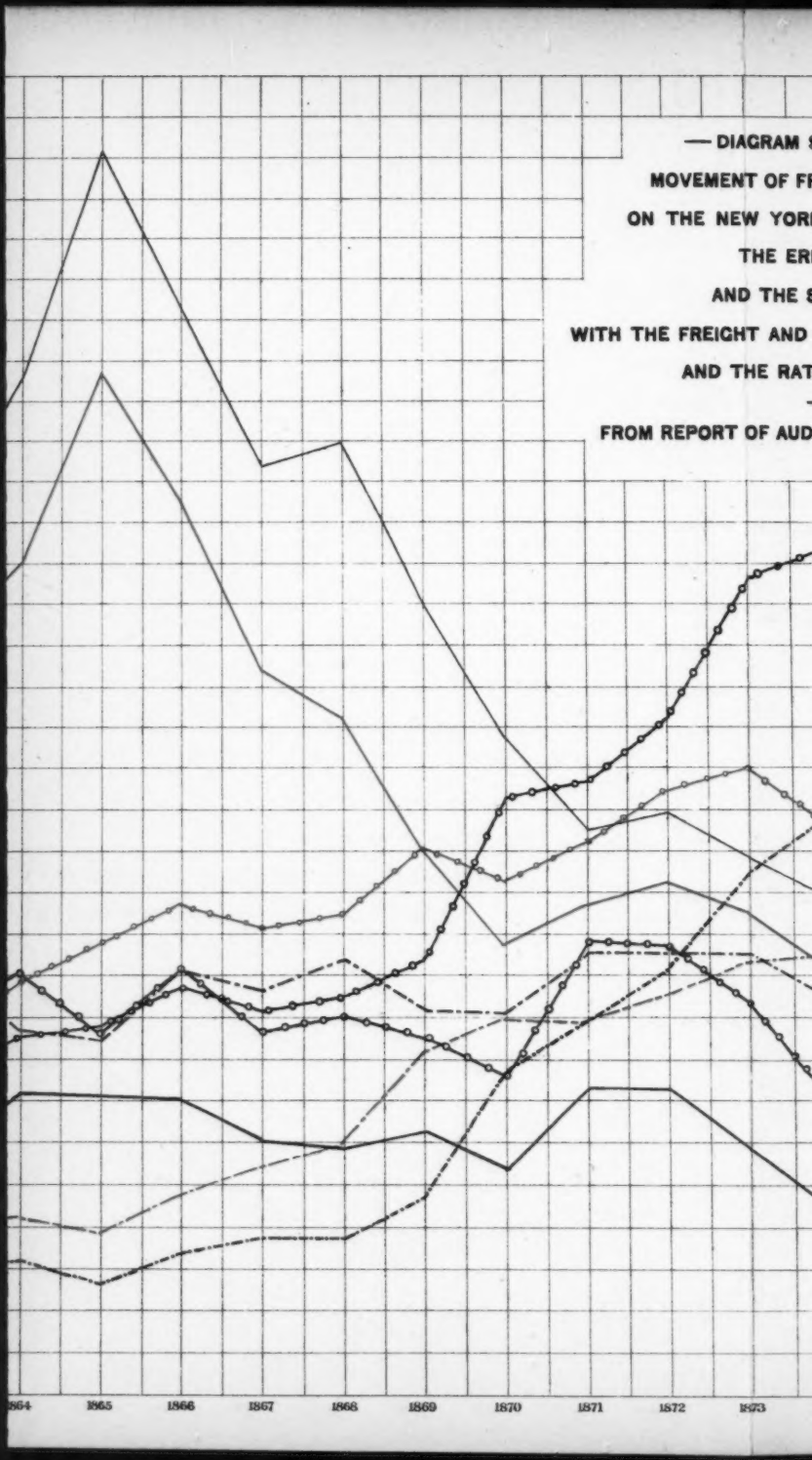
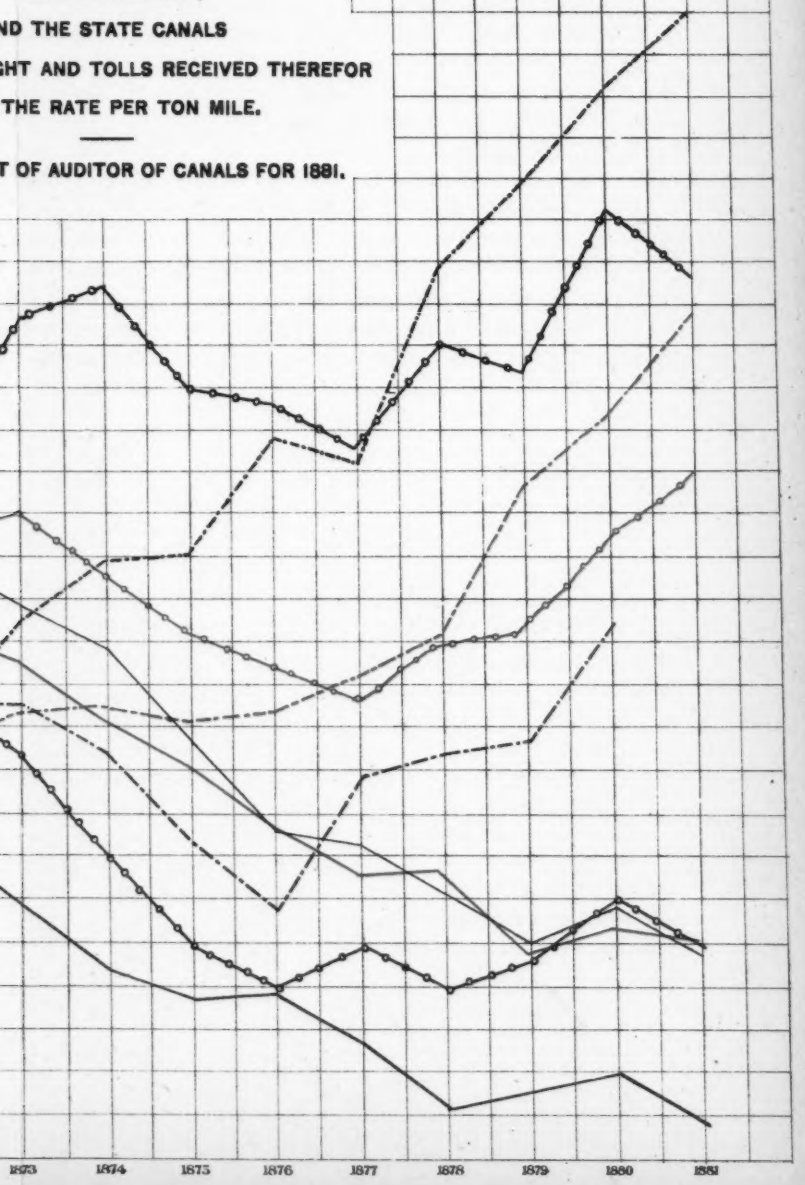


PLATE I.
TRANS. AM. SOC. CIV. ENG'RS
VOL. XIV. Nº 299.
NORTH ON
ENLARGEMENT OF ERIE CANAL.
½ MILLS PER TON MILE
MILLION DOLLARS
MILLION TON MILES
EXPLANATIONS.
NEW YORK CENTRAL R. R.—BLACK.
ERIE RAILWAY—RED.
NEW YORK CANALS—BLUE.
TON MILEAGE.
TOTAL FREIGHT AND TOLLS RECEIVED.
FREIGHT AND TOLLS RECEIVED PER TON MILE.
1856
1857
1858
1859
1860
1861
1862
1863
1864


— DIAGRAM
MOVEMENT OF FR
ON THE NEW YOR
THE ER
AND THE
WITH THE FREIGHT AND
AND THE RAT
FROM REPORT OF AUD
1864
1865
1866
1867
1868
1869
1870
1871
1872
1873

IAGRAM SHOWING THE —
NT OF FREIGHT IN TON MILES
EW YORK CENTRAL RAILROAD,
THE ERIE RAILWAY,
ND THE STATE CANALS
GHT AND TOLLS RECEIVED THEREFOR
THE RATE PER TON MILE.

T OF AUDITOR OF CANALS FOR 1881.



## TABLE No. 15.

Prices, in gold, in the New York market of 20 barrels of flour, Extra State; 100 bushels of wheat, Milwaukee Club; 100 bushels of corn, Western Mixed; 100 bushels of oats; 10 barrels mess pork; 10 barrels mess beef; 100 pounds lard; 100 pounds State Dairy Butter; 100 pounds medium washed clothing wool, compared with the charge reduced to gold of moving the above quantity, 13 tons, 1 000 miles, at the average rates charged by New York Central & Hudson River Railroad, 1869 to 1883.

From Atkinson's "Railway, Farmer and Public."

| | Cost in Gold. | Freight Charges on N. Y. C., 13 Tons, 1 000 Miles, Gold. | Charges per Ton-mile N. Y. C., Rate. | Per Cent. of Freight Charge to Value in New York. |
|---|---|---|---|---|
| | | | *Cents.* | |
| 1869 | $622 68 | $231 40 | 1.78 | 36 61 |
| 1870 | 775 02 | 213 20 | 1.64 | 27 47 |
| 1871 | 735 33 | 182 00 | 1.40 | 24 76 |
| 1872 | 675 92 | 183 30 | 1.41 | 27 16 |
| 1873 | 662 50 | 179 40 | 1.38 | 27 05 |
| 1874 | 748 54 | 170 30 | 1.31 | 22 73 |
| 1875 | 696 40 | 144 30 | 1.11 | 20 73 |
| 1876 | 651 74 | 122 20 | .94 | 18 74 |
| 1877 | 751 95 | 126 10 | .97 | 16 76 |
| 1878 | 569 81 | 119 60 | .92 | 20 98 |
| 1879 | 568 34 | 102 70 | .79 | 18 08 |
| 1880 | 631 32 | 114 40 | .88 | 18 12 |
| 1881 | 703 10 | 107 40 | .78 | 15 27 |
| 1882 | 776 13 | 94 90 | .73 | 12 22 |
| 1883 | 662 11 | 118 30 | .91 | 17 87 |
| 1884 | 621 75 | | | |

## TABLE No. 16.

Showing the tons of freight going from tide water, the tons arriving at tide water from this and other States, the total arriving at tide water, the internal and total movement, with the value of the same and tolls collected, for years 1836 to 1881.

| | Going from Tide Water. | Arriving at Tide Water. | | | | Total arriving at Tide Water. | Internal Movement of this State. | Total Movement. | Value. | Tolls. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | By Way of Erie Canal. | | By Way of Champlain Canal. | | | | | | |
| | | From Western States. | From this State. | From Vermont and Canada. | From this State. | | | | | |
| 1836 | 133,796 | 54,219 | 364,906 | 53,853 | 223,369 | 696,347 | 480,666 | 1,310,807 | | |
| 1837 | 122,130 | 56,255 | 331,251 | 43,546 | 180,729 | 611,781 | 437,385 | 1,171,296 | $55,809,288 | $1,292,623 |
| 1838 | 142,808 | 83,283 | 336,016 | 36,330 | 184,902 | 640,481 | 549,722 | 1,333,011 | 65,746,559 | 1,590 911 |
| 1839 | 142,035 | 121,761 | 264,596 | 56,308 | 159,553 | 602,128 | 691,550 | 1,435,713 | 73,399,764 | 1,616,382 |
| 1840 | 129,580 | 158,148 | 309,167 | 50,900 | 150,797 | 669,012 | 617,454 | 1,416,046 | 66,303,892 | 1,775.747 |
| 1841 | 162,715 | 224,176 | 308,344 | 50,909 | 190,905 | 774,334 | 584.612 | 1.521.661 | 92,202,929 | 2,034,882 |
| 1842 | 123,294 | 221,477 | 258,672 | 30,515 | 155,962 | 666.676 | 447.011 | 1,236,931 | 60,016,608 | 1.749,196 |
| 1843 | 143,595 | 256,376 | 378,969 | 32,126 | 169,390 | 836.861 | 532,983 | 1.513,439 | 76,276,909 | 2,081,590 |
| 1844 | 176,737 | 308,095 | 491,791 | 33,974 | 185,304 | 1,019,094 | 620.755 | 1,816,586 | 90,921,152 | 2,446,374 |
| 1845 | 195,000 | 304,551 | 655,039 | 33,389 | 211,964 | 1,204 943 | 577.622 | 1,977,565 | 100,629,859 | 2,646.181 |
| 1846 | 213,815 | 506,830 | 600,440 | 41,852 | 213,196 | 1,362,319 | 692,528 | 2,268,662 | 115,612,109 | 2,756,106 |
| 1847 | 288,267 | 812,840 | 618,412 | 51,377 | 261,654 | 1,744,283 | 837,260 | 2,869,810 | 151.563,428 | 3,635,381 |
| 1848 | 329,557 | 650,154 | 534,183 | 34,528 | 229,010 | 1,447,905 | 1,018,768 | 2,796,230 | 140 086,157 | 3,252,212 |
| 1849 | 315,550 | 768,659 | 498,065 | 65,471 | 247,751 | 1,579,946 | 999,236 | 2,894,732 | 144,732,285 | 3,268,226 |
| 1850 | 418,370 | 841,501 | 530,358 | 124,033 | 355,155 | 2,033.863 | 624,384 | 3,076,617 | 156,397,929 | 3,273,896 |
| 1851 | 467,961 | 1,045,820 | 462.857 | 80.656 | 387,818 | 1,977,151 | 1.187.621 | 3,582,733 | 159,981,801 | 3,329.727 |
| 1852 | 521,527 | 1,151.978 | 492,726 | 107,941 | 482.182 | 2,334.828 | 1,107,087 | 3,863,441 | 196,603,517 | 3,118,234 |
| 1853 | 584.141 | 1,213,690 | 637,748 | 129,609 | 524,750 | 2,505,787 | 1.157,914 | 4.247.852 | 207,179,570 | 3,204,718 |
| 1854 | 531,831 | 1,094.391 | 602,167 | 108,848 | 412,202 | 3,223,743 | 1,410,288 | 4,165,862 | 210,284,312 | 2,773,566 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1855 | 504,696 | 1,092,876 | 327,839 | 99,928 | 374,950 | 1,895,593 | 1,622,328 | 4,022,617 | 204,390,147 | 2,805,077 |
| 1856 | 573,733 | 1,212,550 | 374,880 | 91,254 | 445,085 | 2,123,469 | 1,418,880 | 4,116,082 | 218,327,062 | 2,748,212 |
| 1857 | 340,176 | 1,019,998 | 197,201 | 92,207 | 407,781 | 1,617,187 | 1,386,698 | 3,344,061 | 136,997,018 | 2,045,641 |
| 1858 | 287,073 | 1,273,099 | 223,588 | 93,069 | 395,386 | 1,985,142 | 1,392,977 | 3,665,192 | 138,568,844 | 2,110,754 |
| 1859 | 317,459 | 1,036,634 | 414,699 | 122,917 | 547,422 | 2,121,672 | 1,342,553 | 3,781,684 | 132,160,758 | 1,723,945 |
| 1860 | 373,735 | 1,896,975 | 379,086 | 104,150 | 474,666 | 2,854,877 | 1,421,602 | 4,650.214 | 170,849,198 | 3,009.597 |
| 1861 | 340,736 | 2,158,425 | 291,184 | 53,096 | 477,442 | 2,980,144 | 1,186,755 | 4,507,535 | 130,115,893 | 3,908,785 |
| 1862 | 417,623 | 2,594,837 | 322,257 | 72,601 | 413,014 | 3,402.709 | 1,778,453 | 5,598,785 | 203,234,331 | 5,188,943 |
| 1863 | 456,800 | 2,279,252 | 368,437 | 198,116 | 428,922 | 3,274,727 | 1,826,165 | 5,557,692 | 240,046,461 | 4.645,207 |
| 1864 | 493,913 | 1,907,136 | 239,498 | 195,532 | 466,091 | 2,805,257 | 1,553,771 | 4,852,941 | 274,400,639 | 3,983 982 |
| 1865 | 458,684 | 1,904,156 | 174,205 | 202,331 | 449,489 | 2,730,181 | 1,540.789 | 4,729,564 | 256,237,104 | 3.839,955 |
| 1866 | 626,974 | 2,235,716 | 287,948 | 220,890 | 561.053 | 3,305.607 | 1,842,639 | 5,775,220 | 270,963,676 | 4,436,639 |
| 1867 | 792,573 | 2,129,405 | 96,707 | 206,634 | 596,949 | 3,029,695 | 1,866,057 | 5,688,325 | 278,956,712 | 4,088,058 |
| 1868 | 1,067,020 | 2,215,222 | 163,350 | 193,474 | 668,760 | 3,240,806 | 2,134,399 | 6,442,225 | 305,301,929 | 4.246,563 |
| 1869 | 772,201 | 2,028,568 | 229,121 | 203,876 | 634,577 | 3,096,142 | 1,990,737 | 5,859,080 | 249,381,284 | 3,778,501 |
| 1870 | 940.429 | 2,048,947 | 241,751 | 244,617 | 620,987 | 3,156,302 | 2,077,038 | 6,173,769 | 231,836,176 | 2,611,578 |
| 1871 | 801,538 | 2,473,852 | 175,045 | 912,054 | 634.870 | 3,495,801 | 2,170 549 | 6.467.888 | 238,767,691 | 3,100,838 |
| 1872 | 926,228 | 2,456,022 | 214.383 | 261,058 | 716,481 | 3,647,944 | 2,099,198 | 6,673,370 | 220,913,321 | 3,072,411 |
| 1873 | 795,117 | 2,359,455 | 225,900 | 27,895 | 763,399 | 3,376,649 | 2,193,016 | 6,364,782 | 191,715,500 | 2,976,718 |
| 1874 | 753,981 | 2,200,364 | 269,933 | 193,523 | 559,292 | 3,223,112 | 1,827,495 | 5,804,588 | 196,674,322 | 2,637,071 |
| 1875 | 701,253 | 1,664,056 | 250,886 | 135,115 | 518,720 | 2,608,777 | 1,549,828 | 4,859,858 | 145,008,575 | 1,590,032 |
| 1876 | 745.797 | 1,402,768 | 342,552 | 128,223 | 552,639 | 2,426,182 | 1,000.150 | 4,172.129 | 113,090,379 | 1.340.004 |
| 1877 | 978.991 | 2,010,081 | 287,927 | 156,150 | 532,654 | 2,986,812 | 990,160 | 4,955.963 | 128,923,890 | 880,896 |
| 1878 | 783,150 | 2,450,512 | 381,278 | 151,081 | 654.230 | 3,637,101 | 751,069 | 5,171,320 | 182,254,528 | 993,348 |
| 1879 | 992,434 | 2,196,177 | 349,825 | 151,913 | 588,261 | 3,286,176 | 1,083,762 | 5,362,372 | 285,280,726 | 941,574 |
| 1880 | 1,264,179 | 2,801,282 | 425 076 | 224.437 | 616,607 | 4,067,402 | 1,126,075 | 6,457.656 | 247,844,790 | 1,155,419 |
| 1881 | 1,056,196 | 1,804,120 | 389,182 | 212.179 | 660,858 | 3,065,839 | 1.057,157 | 5,179,192 | 162,153,565 | 632,390 |

## TABLE No. 17.

CLASSIFIED EXHIBIT OF FREIGHT IN TONS, OF 2 000 POUNDS, CARRIED ON ALL THE CANALS, 1861 TO 1881.

| | Fur and Peltry. | Boards, Scantlings, Shingles, Timber, Staves, Wood, Ashes, Pot and Pearl. | Pork, Beef, Bacon, Cheese, Butter, Lard, Tallow and Lard Oil, Hides, Wool, Live Stock. | Flour, Wheat, Rye, Corn, Corn Meal, Barley, Barley Malt, Oats, Bran, Peas and Beans. | Apples, Potatoes, Dried Fruit. | Cotton, Unmanufactured tobacco, Hemp, Clover and Grass Seed, Hops and Flax Seed. | Domestic Spirits, Oil Meal, Leather, Furniture, Bar and Pig Lead, Pig, Bloom and Bar Iron, Castings and Iron-ware, Domestic Woolens, Domestic Cottons. | Domestic Salt. | Foreign Salt. | Sugar, Molasses, Coffee, all other Merchandise, Sundries. | Nails, Spikes and Horse-shoes, Iron and Steel, Railroad Iron, Flint Enamel, Crockery and Glass-ware. | Stone, Lime and Clay, Gypsum, Anthracite Coal, Bituminous Coal, Copper Ore, Iron Ore, Phosphate Rock, Petroleum. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 1861 | 155 | 1 052 237 | 19 412 | 2 092 900 | 29 337 | 2 854 | 68 753 | 208 116 | 3 487 | 300 397 | 25 285 | 704 802 |
| 1862 | 109 | 1 569 565 | 68 317 | 2 350 675 | 71 923 | 3 169 | 92 663 | 234 925 | 37 289 | 143 478 | 30 999 | 1 001 193 |
| 1863 | 170 | 1 628 518 | 87 677 | 2 044 146 | 99 938 | 4 366 | 99 679 | 209 998 | 9 755 | 232 115 | 59 226 | 1 082 104 |
| 1864 | 24 | 1 478 897 | 43 583 | 1 458 534 | 65 347 | 5 457 | 83 648 | 192 062 | 6 644 | 217 270 | 52 831 | 1 248 641 |
| 1865 | 110 | 1 467 205 | 27 331 | 1 554 539 | 108 158 | 6 153 | 84 538 | 187 037 | 10 257 | 211 636 | 38 850 | 1 033 840 |
| 1866 | 418 | 1 769 576 | 18 856 | 1 704 560 | 59 371 | 3 319 | 90 404 | 207 166 | 4 671 | 242 464 | 56 967 | 1 617 448 |
| 1867 | 283 | 1 743 969 | 16 710 | 1 335 887 | 80 470 | 6 016 | 85 245 | 229 640 | 5 959 | 310 194 | 90 719 | 1 762 703 |
| 1868 | 11 | 1 958 288 | 12 102 | 1 356 271 | 62 904 | 4 896 | 98 808 | 266 760 | 7 694 | 384 769 | 166 986 | 2 116 716 |
| 1869 | 11 | 1 855 918 | 8 722 | 1 238 485 | 64 128 | 2 767 | 77 586 | 258 927 | 3 726 | 321 761 | 153 445 | 1 871 602 |
| 1870 | 1 | 1 916 512 | 10 718 | 1 203 374 | 91 634 | 3 438 | 75 757 | 263 437 | 3 303 | 297 652 | 161 192 | 2 146 741 |
| 1871 | ..... | 1 941 297 | 8 651 | 1 770 621 | 79 577 | 5 027 | 87 579 | 246 220 | 2 489 | 261 732 | 201 995 | 1 863 700 |
| 1872 | 3 | 1 950 795 | 5 741 | 1 597 580 | 76 740 | 3 903 | 77 006 | 244 222 | 4 336 | 244 719 | 189 420 | 2 278 905 |
| 1873 | 28 | 1 582 044 | 2 815 | 1 670 248 | 74 923 | 2 434 | 51 114 | 212 730 | 3 976 | 183 716 | 71 109 | 2 509 704 |
| 1874 | ..... | 1 482 753 | 2 559 | 1 504 678 | 262 920 | 2 427 | 73 107 | 167 801 | 5 789 | 227 405 | 41 145 | 2 034 004 |
| 1875 | ..... | 1 250 546 | 2 253 | 1 241 760 | 63 790 | 3 810 | 88 946 | 184 252 | 2 533 | 181 581 | 49 155 | 1 791 332 |
| 1876 | ..... | 1 175 313 | 1 899 | 996 829 | 67 464 | 1 304 | 66 131 | 110 965 | 3 105 | 301 240 | 19 933 | 1 427 942 |
| 1877 | 72 | 1 312 382 | 12 440 | 1 442 056 | 60 491 | 7 335 | 62 531 | 116 340 | 5 347 | 208 342 | 19 465 | 1 709 093 |
| 1878 | 4 | 1 364 116 | 4 782 | 1 849 513 | 63 221 | 3 720 | 80 136 | 133 148 | 6 779 | 296 358 | 22 246 | 1 347 297 |
| 1879 | ..... | 1 368 849 | 1 641 | 1 773 754 | 59 645 | 15 307 | 119 282 | 132 794 | 3 227 | 343 879 | 40 436 | 1 503 560 |
| 1880 | ..... | 1 566 764 | 11 613 | 2 306 121 | 64 969 | 25 655 | 133 627 | 139 062 | 5 425 | 500 579 | 115 291 | 1 588 546 |
| 1881 | ..... | 1 652 543 | 3 677 | 1 077 795 | 38 766 | 51 218 | 137 205 | 101 271 | 12 485 | 226 310 | 163 161 | 1 714 761 |

## TABLE No. 18.

Showing the average tonnage of the boats, the time necessary to make a passage, and the cost to bring a barrel of flour from Buffalo to Albany, and the total tons delivered at tide water from the Erie Canal, with the mileage of freight boats and total mileage, 1841–1881.

| Year. | Average Cargo of Boat. | Days' time between Buffalo and Albany. | Toll and Freight on a Barrel of Flour. | Tons delivered at Tide Water from Erie Canal. | Mileage of Freight Boats only. | Mileage of Freight and Packet Boats. |
|---|---|---|---|---|---|---|
| | | | *Cents.* | | | |
| 1841 | 41 | 9 | 71 | 532 520 | 7 103 580 | 7 426 410 |
| 1842 | .... | .... | .... | ..... | 6 173 200 | 6 527 500 |
| 1843 | .... | .... | .... | ..... | 6 586 700 | 6 968 520 |
| 1844 | 49 | 7½ | 60 | 799 816 | 7 841 750 | 8 268 490 |
| 1845 | .... | .... | .... | ..... | 7 924 250 | 8 344 790 |
| 1846 | .... | .... | .... | ..... | 9 065 450 | 9 479 790 |
| 1847 | 67 | 10½ | 77 | 1 431 252 | 11 733 250 | 12 176 330 |
| 1848 | 71 | 9 | 58 | 1 184 337 | 9 633 850 | 10 176 150 |
| 1849 | 68 | 8¾ | 56 | 1 266 724 | 10 153 350 | 10 459 110 |
| 1850 | 76 | 9 | 58 | 1 554 675 | 10 718 100 | 11 061 575 |
| 1851 | 78 | 8½ | 49 | 1 508 677 | 11 926 950 | 12 133 100 |
| 1852 | 80 | 9 | 53 | 1 644 699 | 12 306 950 | 12 378 675 |
| 1853 | 84 | 9 | 56 | 1 851 438 | 12 327 050 | 12 373 700 |
| 1854 | 94 | 8½ | 52 | 1 702 693 | 11 244 200 | 11 268 875 |
| 1855 | 92 | 8½ | 52 | 1 420 715 | 9 671 450 | 10 700 325 |
| 1856 | 100 | 8¼ | 60 | 1 587 130 | 9 656 700 | 9 677 875 |
| 1857 | 100 | 8½ | 46 | 1 117 199 | 7 347 850 | 7 391 800 |
| 1858 | 126 | 8¼ | 34 | 1 496 687 | 7 886 100 | 7 904 825 |
| 1859 | 143 | 8½ | 31 | 1 451 333 | 7 010 750 | 7 033 375 |
| 1860 | 140 | 8½ | 42 | 2 276 061 | 9 930 300 | 9 951 450 |
| 1861 | 157 | 8½ | 46 | 2 449 609 | 10 351 350 | 10 373 650 |
| 1862 | 167 | 8½ | 48 | 2 917 094 | 13 021 950 | 13 042 400 |
| 1863 | 177 | 9 | 45 | 2 647 689 | 11 974 550 | 12 045 600 |
| 1864 | 150 | 10 | 57½ | 2 146 634 | 10 748 650 | 10 762 600 |
| 1865 | 160 | 10 | 51 | 2 078 361 | 9 576 750 | 9 627 950 |
| 1866 | 170 | 10 | 52 | 2 523 664 | 11 376 400 | 11 399 425 |
| 1867 | 156 | 10 | 48 | 2 226 112 | 10 101 400 | 10 122 400 |
| 1868 | 148 | 10 | 48 | 2 378 572 | 9 403 400 | 9 433 450 |
| 1869 | 183 | 10 | 51 | 2 257 689 | 8 263 650 | 8 397 075 |
| 1870 | 181 | 10 | 33 | 2 290 698 | 8 674 550 | 8 689 475 |
| 1871 | 178 | 11 | 40 | 2 648 877 | 9 345 150 | 9 358 100 |
| 1872 | 190 | 11 | 42 | 2 670 405 | 9 780 300 | 9 792 500 |
| 1873 | 213 | 11 | 46½ | 2 585 355 | 9 480 900 | 9 485 450 |
| 1874 | 197 | 11 | 31 | 2 370 297 | 8 004 850 | 8 010 625 |
| 1875 | 204 | 11 | 23 | 1 914 942 | 6 618 450 | 6 621 175 |
| 1876 | 209 | 11 | 19 | 1 745 320 | 5 823 200 | 5 830 775 |
| 1877 | 214 | 11 | 21 | 2 298 008 | 7 019 615 | 7 019 615 |
| 1878 | 215 | 10 | 16 | 2 831 790 | 8 459 551 | 8 459 551 |
| 1879 | 197 | .. | 20 | 2 546 002 | 8 226 947 | 8 226 947 |
| 1880 | 215 | *10½ | 18 | 3 226 358 | 10 400 931 | 10 400 931 |
| 1881 | 216 | 10 | 12 | 2 193 302 | 6 666 980 | 6 666 980 |

* The boats timed during month of August average 9 days, 9 hours and 12 minutes.

WILLARD S. POPE, M. Am. Soc. C. E.—I suppose no one questions the desirability of a route by which the vessels that navigate the great lakes can reach the ocean. The northwestern States are, and must continue to be, the food-producing regions for the manufacturing States along the seaboard, and for a part at least of Europe. The distances are great, and the products are bulky and low priced, and, of course, cheap transportation is absolutely essential. The costs and delays of transfer from lake craft to canal boats, and again from canal boats to ocean vessels, are considerable; and if it is possible to do so at any reasonable expense, they must be avoided. There are now on the lakes many steam propellers drawing 15½ feet of water, and carrying from 75 000 to 100 000 bushels of grain. Here are the names and dimensions of a few of them:

| NAME. | When built. | Material of which built. | Registered Tonnage. | Carrying Capacity in Bushels of Wheat. | Total Length in feet. | Total Width in feet. | Draft of Water in feet when fully loaded. |
|---|---|---|---|---|---|---|---|
| Commodore. | 1875. | Wood. | *2 082 | 83 000 | 282 | 43 | 15½ |
| Albany... | 1884. | Steel. | 1 678 | 85 000 | 282 | 39½ | 15½ |
| Syracuse... | 1884. | Steel. | 1 678 | 85 000 | 282 | 39½ | 15½ |
| Onoko..... | 1882. | Iron. | 2 164 | 100 800 | 302½ | 40½ | 15½ |

The accompanying letter of Gen. Poe, the engineer in charge of the public works on the lakes, indicates the intention on the part of the Government to obtain ultimately a minimum depth of 20 feet of water. In the future, as in the past, ship-builders will follow up closely the deepening of the channels, and as soon as 20 feet is secured the lake craft will certainly utilize the whole of it.

It is clearly impossible that the present Erie Canal can meet the requirements of the speedy future. Something must be done, and Mr. Sweet is ready with the suggestion of enlarging the canal. He suggests a width of 100 feet on the bottom and a depth of 18 feet. The canal is

*The apparent discrepancy in registered tonnage between that of the *Commodore* and that of the other vessels is probably explained by the fact that the Government system of measurement has been recently changed, and the results in official tonnage are smaller than before.

intended to be a practical continuation of the lakes, and it follows, of course, that if the lakes and their harbors will take 20 feet the canal must be of a like depth. And the locks must correspond. And the canal must be so wide and the banks must be so protected with masonry, that steamers can maintain their full speed without risk of injury to themselves or to the works.

The plan is a magnificent one, and the imagination is dazzled at the thought of the great lake propellers, carrying 100 000 to 150 000 bushels of grain, steaming at from 15 to 20 miles per hour through the heart of the State of New York to their destination in the metropolis at the mouth of the Hudson.

Mr. Sweet thinks the scheme is a practicable one, and mentions 125 to 150 millions of dollars as an approximation to its probable cost. This is for a canal 100 feet wide and 18 feet deep. For the reasons mentioned above it would seem that it should not be less than 150 feet, or better still, 200 feet wide and 20 feet deep. This would, of course, considerably increase the cost, which might then perhaps be taken at 200 millions.

This done, the grain producers would have cheap transportation, and the City of New York would be assured for all the future as the metropolis of the continent, and as doubtless the greatest city in the world.

But before we become blinded by the magnificence of this imperial design let us examine the real situation. This is an engineering question in its broadest sense, and we should approach it not as New Yorkers or even as Americans, but as cosmopolites. A narrow patriotism may stop at the border of our own country, but, professionally, we can cross the frontier regardless of the tyranny of custom houses or of the limitations of State pride.

The purpose is to get efficient water communication between the Atlantic Ocean and the lakes—or, to localize it more definitely, say between Buffalo and Liverpool.

Let us look at the map.

The waters of the lakes have already an outlet to the ocean quite independent of the Erie Canal or of any of the works of man. The St. Lawrence river is one of the noblest streams on earth. Broad, deep and full, it can float on its waters the navies of the world. It is freely navigable for large ocean steamers up to Montreal.

Let us compare this route with that by way of Albany and New York in some of their respective prominent characteristics.

I. From Buffalo to Liverpool by way of the Erie Canal and New York is 3 450 miles; and between the same points by way of Montreal and the Gulf of St. Lawrence is 3 180 miles; a difference of 270 miles in favor of Montreal, which represents a saving of nearly a day in time.

II.—As far as winter transportation is concerned the two routes are on a par. Both would be closed by ice for about the same length of time.

III.—The amount of lockage is, of course, the same in either case, so that delays from this source would be alike.

IV.—The Welland Canal around the falls of Niagara is 28 miles long, and the lateral canals around the rapids of the St. Lawrence river, between Kingston and Montreal, aggregate 41 miles; making in all 69 miles of artificial water course. From Buffalo to deep water in the Hudson river below Albany is, say 315 miles—a saving in favor of the Montreal route of 246 miles of costly canal digging.

V.—The St. Lawrence route would utilize and secure the trade of the whole of Lake Ontario, and the flourishing cities on its borders, none of which could be reached by the Albany route, except at great additional expense through branch canals.

VI.—Over the Erie Canal a great number of heavy and costly drawbridges must be built and maintained. The Canadian canals, being for the most part along the immediate bank of the river, would need very few such structures.

VII.—In the long levels between the locks of the Erie Canal, where vessels would naturally be run at their highest speed, the banks must be protected from the wash of the swells by heavy walls of masonry. On the other route the long reaches between the locks are in the main river, where no bank protection is needed.

VIII.—The Erie Canal in places will be above the general level of the land, notably so at the crossing of the Seneca River, where Mr. Sweet says the water surface of the canal must be about 50 feet above that of the river. A break in the embankment at such a place would be a very serious disaster, not only stopping navigation, but doing great damage to the surrounding country. In the St. Lawrence canals the circumstances are very different, and no such danger is to be feared.

IX.—All these things go to modify cost of construction and maintenance, and whatever sum may be assumed for the Erie Canal, it would

seem apparent to any fair judgment that it must be at least six times the amount that would be needed for the St. Lawrence route. And, after all, this is the crucial test. For public works, like private enterprises, must in some way be made to pay their maintenance and a fair interest on their original cost, or they are failures. [I speak now, of course, of commercial, not of political or military schemes.] It matters not whether this is paid by tolls charged on the traffic, or directly out of the national treasury. In either case the public pay it; the Government never had a penny that was not taken in some way from the pockets of private individuals.

And now what remains? If the same facilities, and even better, can be got by the expenditure of thirty-three millions than by the expenditure of two hundred millions, where is the ground for hesitation and doubt as to the course for prudent sensible men to adopt? Simply this—reluctance to depend in any way upon a foreign nation—pride in our own country—the sentiment which we call patriotism. If the object is to gratify this sentiment—to enforce a Chinese-like national exclusion—to build up New York City—then by all means let us enlarge the Erie Canal. But if the object is, as we first stated it, to secure cheap, rapid and reliable transportation from the lakes to the seaboard, then let us take the route that God, the great Engineer, has laid out for us. What if it be through a foreign soil? The builders of the Suez Canal went through a foreign soil. Frenchmen are building the Panama Canal through a foreign soil. Our own Government is now considering a treaty whereby it may be able to build a canal through the foreign soil of Nicaragua. Why hesitate here? And besides, it may not always be foreign soil. Canada gravitates toward the United States, and some day the fruit must surely fall. And that day will be greatly hastened by the mutuality of interest which a joint enterprise like this will bring about. And even if that day should never dawn, it is reasonable to believe that treaty stipulations can be made such as will surely protect our interests. And in the dire event of war, we can turn to England and her present operations in Egypt for a precedent. She protects her interests in the Suez Canal, and we can follow her example.

Letter from Gen. O. M. Poe, M. Am. Soc. C. E., to Willard S. Pope, Esq.

Dear Sir,—In accordance with your request, that I furnish you with any information in my possession, bearing upon the question of the enlargement of the Erie Canal, to enable the large lake vessels to carry their cargoes to tide-water, as outlined in the letter of John Bogart, Esq., Secretary Am. Soc. C. E., dated December 24th, 1884, it affords me pleasure to comply to the extent of my power.

It is well known that the size and draught of vessels on the lakes depend upon the available depths in the navigable channels—that as these depths are increased by channel improvements the vessels keep pace. The draught of the larger vessels has always been controlled in a great measure by the depth of water on St. Clair Flats. Previous to 1858 this was only about 9½ feet, and by way of the North Pass. Improvements at the South Pass completed about that time afforded a depth of about 12 feet, and shortened the distance. In 1871 the St. Clair Flats Canal, with a depth of 13 feet, became available. This was increased in 1874 to 16 feet. As these successive improvements were completed, the channel entrances to the important lake harbors were correspondingly deepened, and vessels were constructed to utilize this increased depth of the channels.

But the full effect was not felt until after the completion of the enlargement of St. Mary's Falls Canal in 1881. Previous to that time the depth of water in the canal was 12 feet. It was increased to 16 feet.

In 1864 the average registered tonnage of vessels passing the canal was 405 tons. In 1882 this had increased to 560 tons.

Unfortunately we are unable to carry this comparison any further, because of a change in the registry laws which then took effect. But the average freight tonnage during the next two years rose from 461 tons in 1882 to 540 tons in 1884, or an increase of more than 17 per cent.

These facts are mentioned only to show how rapidly shipping in this region conforms to increased facilities. I have no means of instituting a similar comparison between the average tonnage at other points, but there can be no doubt but it has increased quite as rapidly.

In 1857 a vessel capable of carrying 25 000 bushels of wheat was considered as large proportionately as one carrying 75 000 bushels now is. But the limit of possibility has not yet been reached, nor will it have been until the channels have a navigable depth of 20 feet. This must

be looked for in the near future, and is now being attained in the improvement in progress at the Lime Kiln Crossing, Detroit river, which, if nothing unforeseen occurs, will be completed in less than two years hence. Then the deepening of the Lake St. Clair and St. Mary's River Channels must follow, and with them the entrances to the principal harbors, and we will have vessels loading with 4 000 tons, instead of 3 000, which some of them now carry. And it would be done at little, if any greater cost.

The construction of the larger vessels now employed, and the more general use of steam, have resulted in a corresponding reduction of lake freight charges, and the more rapid transportation of western products to the eastern markets. These results have been further affected by the system of towing in vogue. I am not prepared to give statistics to show accurately the extent to which these have gone. But it is safe to say that the freight charges do not average more than one-third those of twenty-five years ago. If the transhipment at Buffalo could have been avoided, and vessels could have delivered their cargoes at the seaboard, it is manifest that the same rate of decrease in cost would have been maintained throughout the whole route. Neither am I able to make an accurate comparison between the aggregate quantity of freight at that time and now, but the tonnage passing Lime Kiln Crossing by vessels in 1883 was about 18 000 000 tons, or six times as much as that which crossed Detroit river by rail, a fact which will sufficiently impress one as to the magnitude of the commerce now.

It is such a commerce that must be taken care of, and which must be considered in any project for an enlargement of the Erie Canal. And to produce the best results the canal must be made for 20 feet of water.

That depth will permit the passage of vessels drawing 18 feet, and it is not too visionary to suppose that such vessels might load at Chicago and deliver their freights in European ports without breaking bulk.

Let it be granted that it would cost a large sum of money to sufficiently enlarge the canal to admit of this. Is not the object great enough to justify the expenditure? The history of river and harbor improvements on the lakes amply demonstrates it.

Yours truly,

O. M. POE,

*M. Am. Soc. C. E.*

Mr. M. M. DRAKE.—Mr. President and gentlemen:—At your request, as communicated to me by the Secretary of your Society, I have prepared this article, and although the subject is too important to be treated carelessly, yet I fear that, owing to lack of time and ability on my part, this paper may prove of so little interest that the subject may be lost sight of entirely.

It is now some thirty-three years since I became engaged in the business of our Lake commerce, and during those years I have carefully noted the growth and changes incident to a generally prosperous industry. Thirty years ago our largest crafts for transportation of freight did not exceed 20 000 bushels of wheat, or 600 tons weight. If my memory serves me correctly, any craft with over ten feet draft had difficulty in getting over the St. Clair Flats, unless they lightered, and, in fact, but few of our harbors could accommodate them.

Freights fluctuated then as now, reaching as high as 23 to 25 cents per bushel, but the average rate paid then was at least four times greater than the average rate paid in the season of 1883. I do not use this season for a comparison, as I consider it an off year. During the years from 1860 to 1870 large craft were built and put into commission, harbors were gradually deepened to accommodate them, and the Government, recognizing the importance of the interests involved, made and used the necessary appropriations for deepening the St. Clair Flats, and removing other obstructions, until vessels are now enabled to load to 15 feet of water. But during this decade but very little attention was paid to improvements in the way of machinery or anything to reduce expenses. Freights were generally high, vessels in ready demand, and they were built, put into commission, loaded and unloaded, and were run until they were unfit for further service by reason of decay, which was generally the case at five or ten years of age. But after the inflation (effects of the war of the Rebellion) had subsided, vessel owners found it necessary to economize if they received any returns from their property. New railroads had been built both sides of the Lakes, extending from beyond Chicago to the Atlantic coast, and they too began to feel the effects of reaction after a long season of inflation, and a desperate struggle commenced between the railroads, on one side, determined to monopolize the whole carrying trade and wipe out the Lake commerce entirely, and on the other side, an interest that had quietly

and steadily developed our great West, which was loth, at this time, to lay down, without a struggle for longer existence.

Among the devices that were introduced to cheapen the cost of moving property by water, was that of towing, one steamer utilizing her power to the extent of towing five or six other craft. This method of moving property, notably lumber, has had the effect of reducing rates of freight below a figure that would pay running expenses of a craft if running alone, and still those engaged in the business, I believe, are receiving fair returns from their investment. Outside of the business of moving lumber, however, I look for its entire abolishment at an early day.

During the struggle larger crafts were built, engines to propel them were designed, reducing the average cost of fuel (one of the largest items in the expense of running a steamer) fully 50 per cent. To illustrate, I will cite the case of a steamer of the then largest class, belonging to the line I was employed by. The steamer had a carrying capacity of 1 300 tons, and required fully 300 tons of coal to steam the round trip to Chicago. On one of her trips she took fire and burned to the water's edge, was afterwards raised, brought into port, rebuilt, engines compounded, boilers shortened, hull deepened, but other lines and dimensions of the original boat were preserved, and to-day the craft is doing good work, her average load being 1 600 tons, and requiring but 150 tons of fuel to steam the same trip that formerly required the 300 tons.

Another important feature was adopted during those years of low rates in the way of caring for the property. This has been carried to such an extent that our vessels are in better condition at 15 years of age than formerly at 7. This has been attained by the liberal use of salt, brine, air and cleanliness.

The effort on the part of the rail lines to crush out our lake commerce has been abandoned, and the fact that they recognize the impossibility of doing so requires no further proof than this.

At the present time one of our largest railroad interests, controlling a trunk line each side of the lakes, has invested largely in vessel property, and are now engaged in building more vessels, having demonstrated the fact beyond question that the carrying trade could not be diverted or forced from its natural channel.

To-day we find freights at a very low rate. Railroads are defaulting

the interest on their bonds. Some are being forced into the hands of a Receiver, while our lake craft are quietly pursuing their way, and while not paying large dividends to their owners, yet more than paying expenses, and I am fully convinced that steamers can and will be constructed that will pay a fair interest on the investment at the present low rate of freights. To bear this out, I will present the following figures: An iron or steel steamer of, say, 2 500 tons capacity can be constructed with all the improved appliances of the present time to facilitate and economize in the expense of the running and handling of cargoes for $175 000 ($7 per ton). It will require on an average 12 days for a trip to Chicago and return. I would recommend, and have taken as a basis for these steamers, a craft of such lines and power that the passage could be made in from 2½ to 3 days.

Wages for the 12 days to crew, $500; steward's supplies same time, $200; tug bills, $50; fuel, 150 tons coal at $2 25 per ton, $337 50; oil, waste, &c., $25. Cost of trimming, shovelling and elevating, including average shortage, ¾ cents per bushel on 83 000 bushels, $622 50; total cost per trip, $1 735. While the earnings for the one trip based on the present low rates would be as follows: 2 400 tons coal (I make the cargo 100 tons short on west bound, to allow for fuel at this end of the voyage) at 80 cents per ton, $1 920; freight on 83 000 bushels wheat at 1¾ cents per bushel, $1 452; total earnings, $3 372; after deducting running expenses we have left the sum of $1 637. Such a steamer can easily make 17 trips in one season, which would give total earnings, net, of $27 829. Deducting insurance, repairs (ordinary), and commissions, would leave at least $20 000, or about 11 per cent. on the capital invested.

The depreciation on such a craft would not exceed 3 per cent., leaving a net income of 8 per cent. on the investment. In times past such returns on vessel property would be looked upon as very small, but I believe that the time is at hand that capital must be content with lighter returns in all branches. With lines formed of such steamers as I have mentioned, more regularity in the way of arrivals and departures can be preserved, thereby making a saving in the cost of handling the property being transported. In the present state of things vessels become bunched, and four or five of the same line will arrive on the same day, taxing all the facilities, and in fact requiring more than would be necessary, provided they were of such construction and power that no ordinary gale would materially affect them. Of course the foregoing figures

are based upon a first-class craft, such as will eventually supersede all others in our lake carrying trade—steamers that will make good time in all weathers, and deliver their cargoes in good order.

The part that this natural waterway has taken in the development of our country's resources has been a large one in the past, and it is safe to conclude that it will be still greater in the future. Our great northwest is just now being called upon to furnish her part of the vast wealth contained in her fertile lands and mineral producing mountains, and it can be best made available by cheap transportation.

We must not close our eyes to the fact that this country has strong rivals in furnishing the European markets with breadstuffs. In those countries the labor is below any possible competition on our part, hence the necessity of reducing the cost in other items of expenses and in delivering our products in those marts.

This can be accomplished or assisted by the introduction of such steamers as I have outlined above. I have confined my present ideas to a capacity of 2 500 tons, as that appears to me to be as large as the present demands, although I am not prepared to say that steamers of much greater capacity could not be operated safely, and still more profitably. We have now in commission an iron steamer of full 3 000 tons, and, so far as I know, she is a very successful one, but, as her owners are building another of less dimensions, this fact confirms me in my position of what capacity is the most desirable.

The substitution of iron for wood in the construction of our lake steamers will have an important bearing in the problem of cheap transportation, not only in the fact that they are very much lighter than wood, thereby increasing their carrying capacity to that extent, but being restricted in the depth of water has been and is a serious drawback in the construction of wood steamers of above 2 000 tons capacity, as, in order to give them the necessary strength, a greater depth of hold is required than the draft of water warrants. In iron this difficulty is entirely obviated.

We are now inaugurating a still greater advantage by using steel instead of iron, furnishing a still lighter craft with largely increased strength. As a matter of course, these steamers are above the cost of wood, but their great strength, increased carrying capacity and durability more than compensates for the increased investment.

On our fresh waters I see no reason why these steamers should not last

50 to 75 years. The oldest iron craft here now, I believe, is the U. S. steamer *Michigan*, which has passed her 40th year, and has just had her wood work all renewed. Her service has been somewhat easier than one of our freight steamers would be subject to, but, on the other hand, she is of much lighter construction.

Now, the facilities for rapid and economical handling of cargoes has fully kept pace with the growth and improvements of our vessels, in some cases, loading a cargo of 90 000 bushels in less than 3 hours, 2 000 tons coal in 8 to 12 hours, and unloading grain at the rate of 10 000 bushels per hour, and coal at the rate of 150 tons per hour.

In conclusion, I beg to say that if an increased depth of water to the extent of 5 feet, or at least 3 feet, is made by further appropriations from the Government, a very large reduction in the cost of transporting property would be made, as nearly all of our large steamers are constructed of sufficient depth to load to 18 or 20 feet of water.

With the increased tonnage they would be able to carry they would largely increase the receipts, while the expenses would only be increased to the extent of handling the increased portion of the cargo. It may appear to some that the country at large is not interested enough to warrant the outlay of the necessary amounts for such improvements. I think when they contemplate the fact that this great natural waterway is the regulator of freight rates from the West to the Atlantic Coast they will admit the wisdom of such outlay.

It is a very easy matter for the rail lines to form pools and combinations, and force prices beyond what the property can really afford to pay. And prices will be maintained while our crafts are laid up for the winter; but, mark you, as soon as the waterway is open, down go the rates. It has a direct bearing upon our country's prosperity, and the General Government may well foster all waterways of such magnitude.